The Welding Engineer

Founded by L. B. Mackenzie, 1916

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HIGH PURITY OXYGEN

OXYGEN buyers should specify the percentage of purity in their contracts, and insist that deliveries are continuously up to specifications.

Airco high purity oxygen can be bought that way —Why buy oxygen any other way? — we prefer to sell it on that basis.

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Airco Apparatus Factories and Laboratories at Jersey City and Elizabethport, N. J.

ANYTHING and EVERYTHING for OXYACETYLENE WELDING and CUTTING

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What does nation-wide organization mean to you?

CENTRAL WELDING SHOPS, whether working for a single manufacturer or doing general outside work, usually concentrate most of their effort on repair work. Manufacturers should not overlook the possibilities in salvage — possibilities that are indicated by one company which sends all metal material that is unusable for its original purpose to the welding department to be reclaimed in any way the foreman directs.

YOU wouldn't think of buying an automobile made locally in piece-meal quantities, or one sold only in a restricted territory. You want a car with the qualities insured by large production; one sold everywhere so that service may be obtained easily; in short, the product of a nation-wide organization which has its national reputation at stake in YOUR car.

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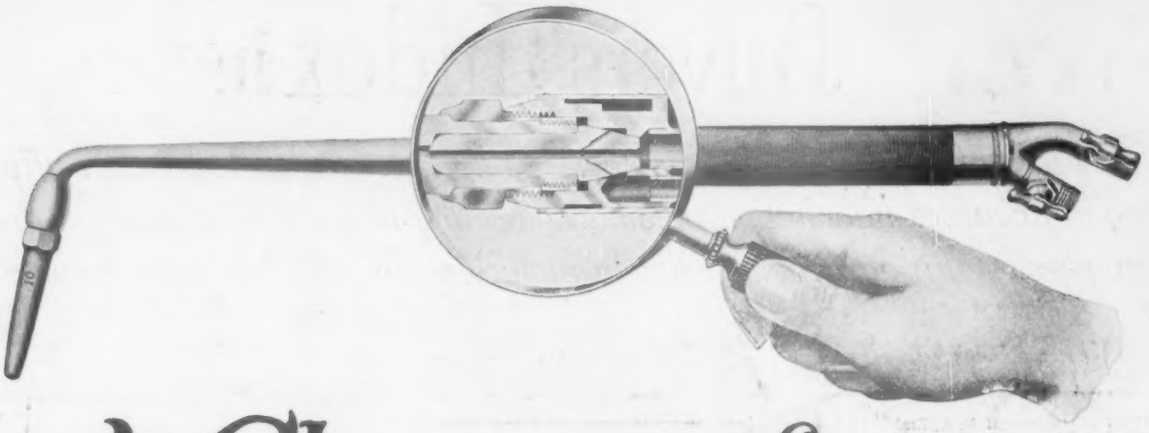
WELDING AND CUTTING APPARATUS

WORLD'S LARGEST MANUFACTURERS OF WELDING AND CUTTING EQUIPMENT



A Close-up of a Good Mixer

GOOD torches must be good gas mixers, thorough mixers, *safe* mixers—and that's one of many reasons why Purox torches are everywhere regarded as thoroughly good torches.

Here's a close-up of the Purox Mixer. Examine it closely; see how it is set back from the tip, giving the torch exactly the right balance for tireless comfort and efficiency and at the same time materially contributing to the well-known Purox safety in operation. Here, heat from the flame at the tip is so far removed that the balance of gas volumes flowing from the mixer into the line ahead is preserved and maintained. Here, also, the two gases unite and, flowing through precisely drilled orifices, into the line ahead, are still more intimately and thoroughly mixed by expansion and contraction of the gas stream diameter. Here, also, "back-fire" is controlled and "flash-backs" are prevented.

The Purox gas-mixture method accounts for the well-nigh ideal 1.03 to 1.00 oxygen-acetylene volume ratio, the perfect combustion obtained at the tip end, and the absence of oxidizing or carbonizing welds.

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Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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See "Torches"

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Nine years' experience.

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See "Torches"

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John A. Roebling's Sons Co.
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Weldit Acetylene Co.

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Carbic Mfg. Co.
Chemical Treatment Company
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Oxweld Acetylene Co.
Purox Co.
Imperial Brass Mfg. Co.
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International Oxygen Co.
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Purox Co.
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Reid-Avery Co.
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Modern Engineering Co.
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Purox Co.
Weldit Acetylene Co.

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Modern Engineering Co.
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Purox Co.
Superior Oxy-Acetylene Machine Co.
United States Welding Co.
Weldit Acetylene Co.

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Torchweld Equipment Co.
Weldit Acetylene Co.

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Weldit Acetylene Co.

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Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
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Imperial Brass Mfg. Co.
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International Oxygen Co.
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Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
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Torchweld Equipment Co.
United States Welding Co.
Weldit Acetylene Co.

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Modern Engineering Co.
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Purox Co.
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Hauck Mfg. Co.
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Davis-Bournonville Co.
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Modern Engineering Co.
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Burdett Oxygen Co.
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Davis-Bournonville Co.
Harris Calorific Co.
International Oxygen Co.
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Purox Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.
Weldit Acetylene Co.

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Modern Engineering Co.
Purox Co.
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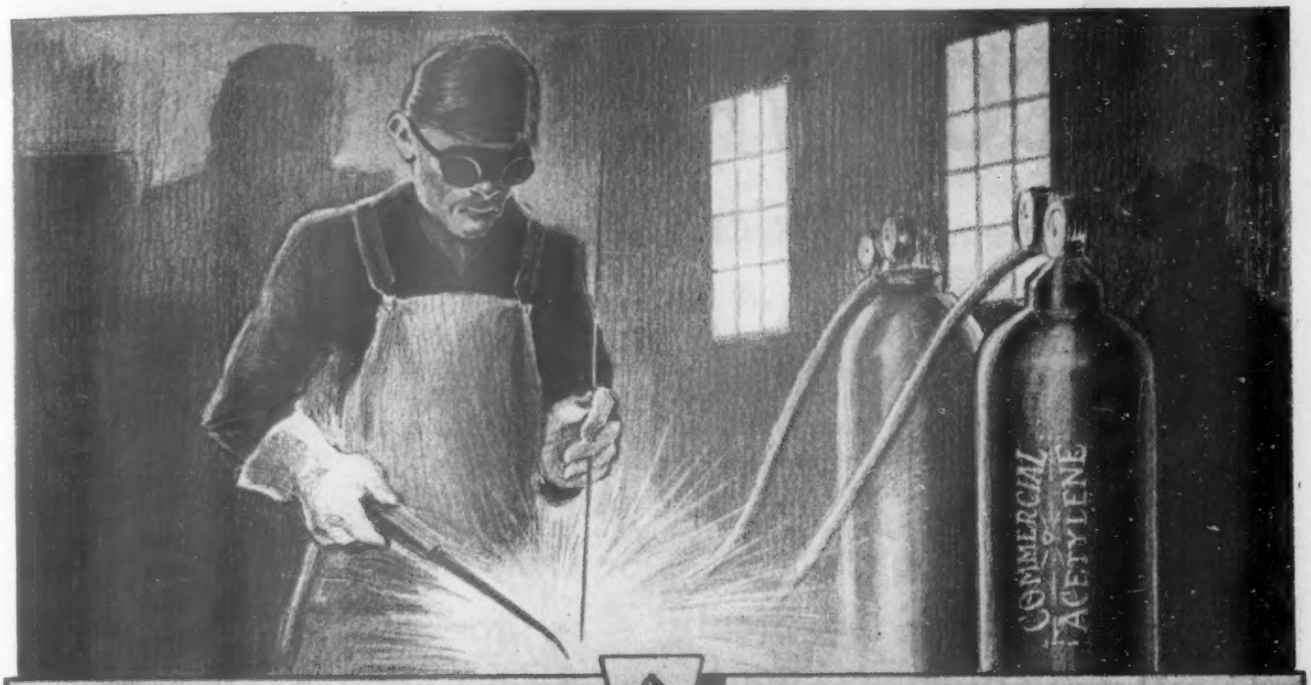

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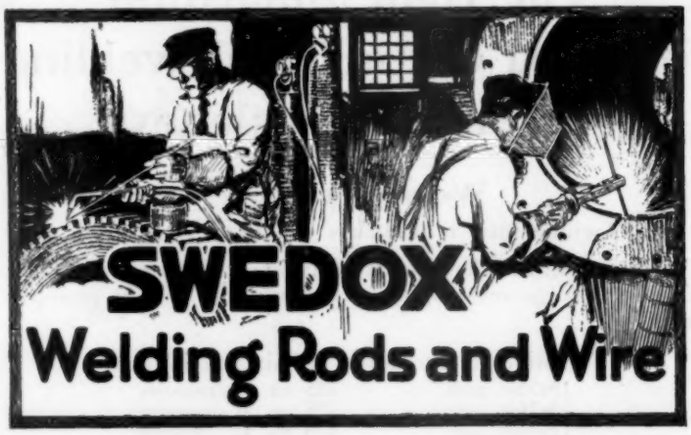

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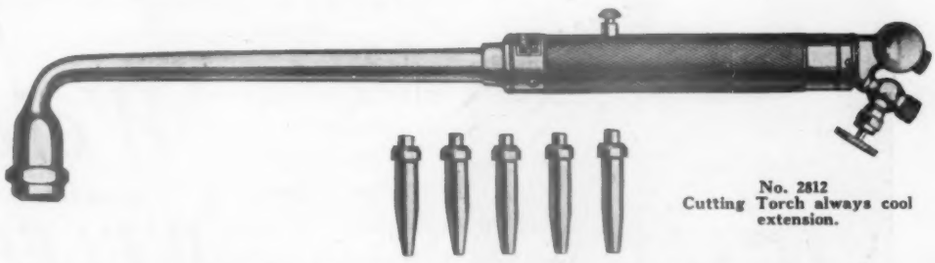

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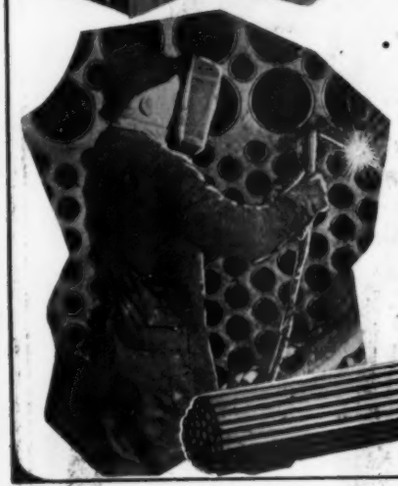

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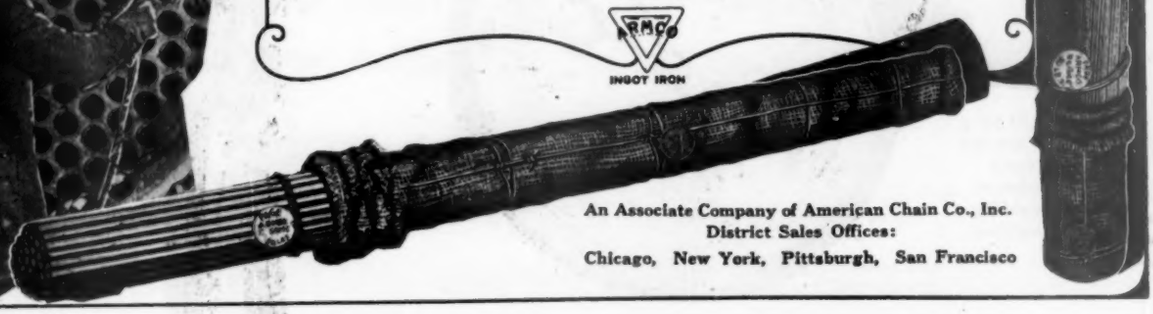

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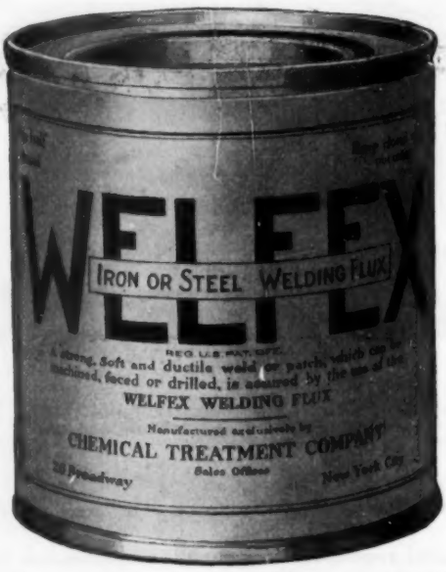

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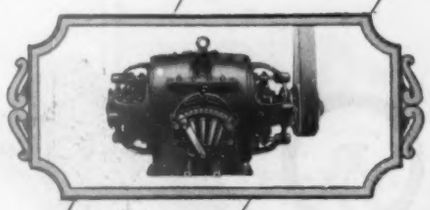

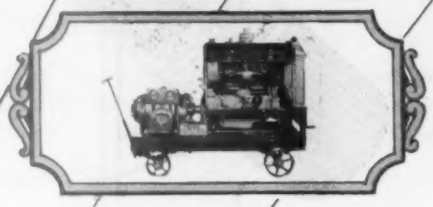

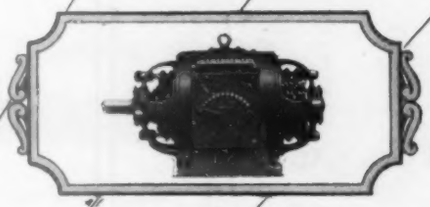

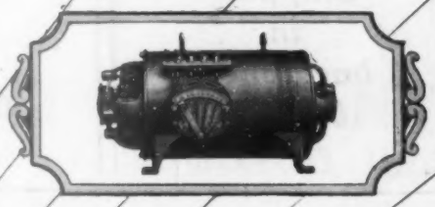

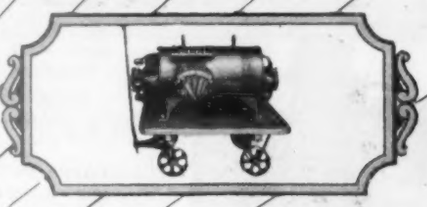

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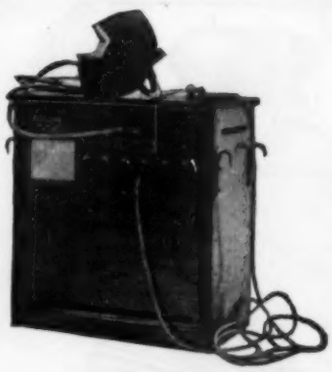

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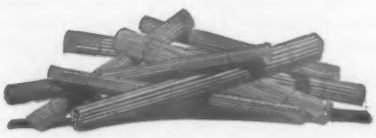

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Electric Arc Welding, by E. Wanamaker and H. K. Pennington. The book covers descriptions of welding systems and their installations, phenomena of the metallic and carbon welding arc, training of operators, methods for applying metal to various types of joints and building-up operations, electrode materials used, weldability of various metals, weld composition, thermal disturbances of parts affected by the welding process, physical properties of completed welds, efficiency of welding equipments, welding cost, etc. 254 pages, 167 illustrations. Size 5 in. x 9 in. Bound in cloth. Price $4.00.

Arc Welding Hand Book—"The Arc Welding Hand Book" by C. J. Holslag, Chief Engineer, Electric Arc Cutting & Welding Co., has just been published by the McGraw-Hill Book Co., New York City. This book is attractively bound in red imitation leather and is comprised of 250 pages and numerous illustrations. It is intended to serve as a simple and practical instruction in arc welding, and an attempt has been made to describe the methods, step by step, so that the beginner may understand both the equipment and the process. To the engineer, draftsman and designer, it should serve as a guide in the use of arc welding. The contents consist of 25 chapters which discuss all phases of arc welding. Price $2.00.

Cutting Iron and Steel With Oxygen, by M. R. Amadeo—A thorough treatise on the use of the cutting torch. Describes apparatus used and methods of operation. Tells influence of oxygen impurities, cutting pressure, effects of preheating cutting oxygen and discusses the heating flame, torch construction, cost of cutting, and cast iron cutting. It is very well illustrated and has many useful cutting tables. Price $1.50.

British Acetylene and Welding Handbook, by a Committee of the British Acetylene and Welding Association. Contains historical and scientific data relating to acetylene, oxygen and carbide. Treatises on the application of acetylene and oxy-acetylene welding and oxy-acetylene cutting. Tests, specifications, regulations, transport conditions, etc., and also the complete reference on acetylene and acetylene welding. Bound in cloth. Price $3.00.

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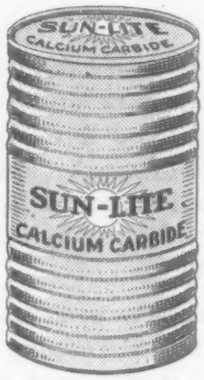

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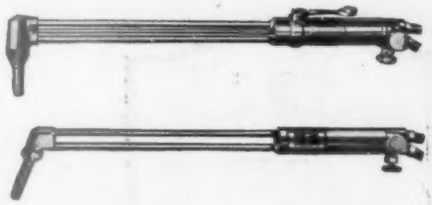

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Acetylene Distribution in the Field*

New Method of Meeting the Old Problem of Fuel Supply to Welding Operators in Pipe Line Work

By G. O. Carter.†

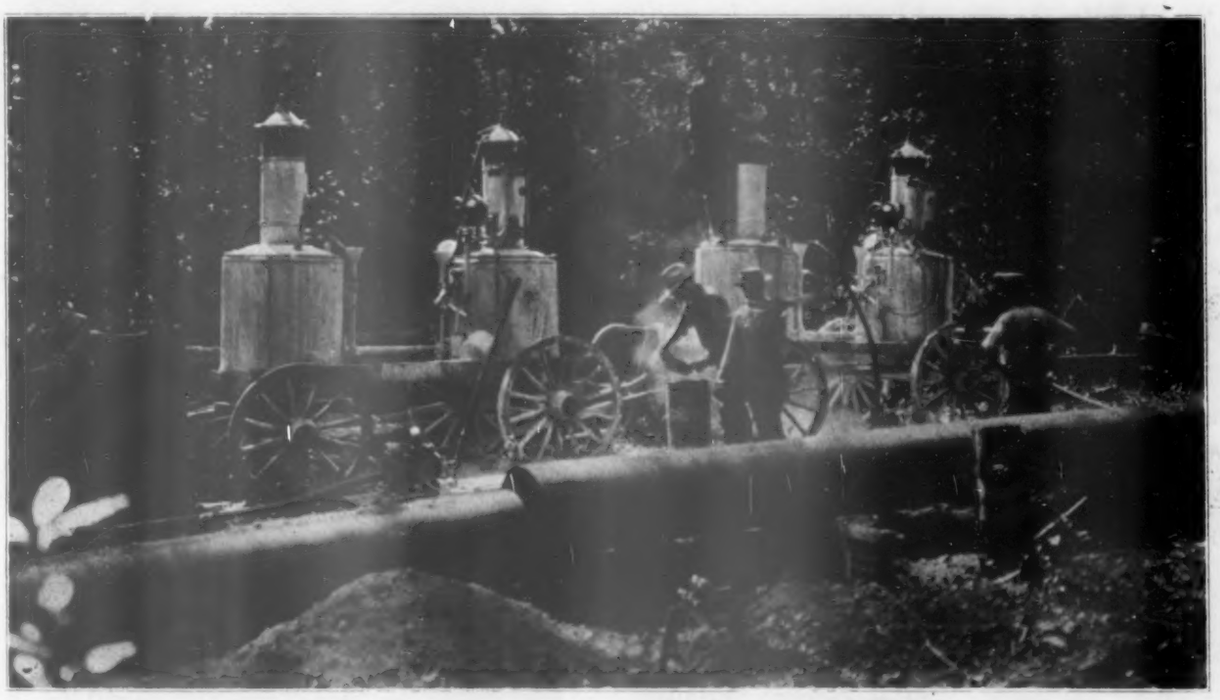
LAST spring, when considering the problem of welding the long pipe line for natural gas, which was to be built in Eastern Texas, one of the unsolved problems was the distribution of acetylene. The president of the Magnolia Gas Company, Mr. F. M. Lege, Jr., who had made a very careful study of welded pipe lines, commented on the cost of moving the acetylene generators along the right-of-way. He suggested that we try to find some way of cutting down the number of teams and the labor required for this operation. As a result of the study given to this problem, it was decided to keep the generators at a fixed position during working hours and to supply acetylene to the welders by means of a small pipe line.

Previous practice had been to have a portable generator mounted on a wagon which would be hauled from welding station to welding station by a team of mules. The single generator would supply four welders, when working on pipe with ⅜-inch walls. The average welding crew consisted of four such gangs working from individual generators, and five other men making tie-in welds, using portable equipment.

In fair weather, there would be a team hitched to each generator wagon; two teams to the portable welding outfits, and two teams on tank wagons hauling water for the generators. If the weather should becomes bad, extra teams would be required for moving the generator—as many as four teams having been hitched to a single generator wagon at times.

By having the generators stationed in one spot during the working hours, the number of teams required for handling the gases has been reduced by at least five. In some cases even fewer teams will do the work. For instance, tank wagons for hauling water will not be required when small gasoline-driven pumps can supply the water from a convenient creek or pond. In East Texas, water is generally scarce during the summer and it is necessary to haul water some distances.

It is quite apparent that generators must be moved at some time or other as work progresses. In the system now being described, this was done immediately after working hours. Generator, wagons were moved by Fordson Tractors, Holt Caterpillars or teams, whichever happened to be most convenient. Some time during the day, the head generator man walked ahead far enough to spot a suitable site for the next set-up. He would then walk back to locate and mark a suitable road for moving the equipment. By a little planning, it soon became possible to move the generators in an hour. The cost of moving must, of course, be charged against the acetylene distribution.



Unit of Four Generators, Mounted in Pairs—Generators Being Charged

After a study of the volume of acetylene required for 16 welders, it was decided to use 1½-inch pipe for the supply line. At first this was made up in 100-foot sections, but it was shortly decided to handle it in lengths of 200 feet. Brass outlet plugs were bronze welded to the steel pipe at approximately 17½-foot intervals. No valves were used on these outlets—they were merely closed by a cap nut. At each end of the pipe, a Mueller stopcock was used to prevent the loss of acetylene and mixing of air. Connections were made by means of common unions.

The procedure for handling the acetylene pipe line is as follows: After the welders have passed a section, the joint is broken and the front end of the pipe is tied to a wagon (sometimes to a single-tree). A team of mules would then drag the pipe to the front of the acetylene pipe line where it would be connected up.

*Paper presented before the International Acetylene Association, Chicago, November 12, 1924.

†Consulting Engineer, Linde Air Products Co.

One team and one or two men are required to move and keep the acetylene supply line in condition.

In the old practice of using single generators, each one with its own team, it was necessary to have a generator man to operate each generator. Under the new plan, with four generators in a fixed position, one generator man and one helper easily take care of all.

When it was decided to use one acetylene supply line with several generators feeding it, there was much doubt as to the regularity of the feed from the generators. It was the belief of nearly everyone familiar with the problem that one generator would tend to carry too much of a load and the others would be working below capacity. In an effort to control the flow of gas from the generators, four flow meters were ordered for the first installation, but these were so low in capacity that they could not handle the volume of gases. In the meantime, it was found that the problem was not as serious a one as anticipated. Six sets of four generators each have operated for weeks at a stretch with no trouble from this source.

When generators were moved singly after each series of welds, the welders would collect their equipment, and place it on the generator wagon; then, when they had reached the new felding station, would uncoil their hose and get set for the next joints. When using the acetylene supply line, the welders disconnect the oxygen regulator from the oxygen cylinder and the acetylene hose from the acetylene line, and then carry their equipment to the next nearby station and hook it up. Welders, therefore, lose little time in moving their equipment, and they could be counted upon to put in a certain definite time of welding every day. Under the old plan, whene generator wagons would have difficulty in moving across wet fields or have to go around creeks and ravines, a great deal of welding time would be lost.

Generators Were Hauled into Place by Holt or Fordson Tractors

Another advantage of the acetylene supply line was that it permitted an entirely different grouping of welders. With single generators, four is the maximum number of welders who can get a steady supply of acetylene, but with three generators always feeding into a common line, it has been found entirely satisfactory for as many as twenty-five welders to work off the system. This seems a little contrary to general acetylene practice, but it was watched very carefully by engineers who were familiar with the requirements for proper generation of acetylene.

It was estimated that the change in the method of supplying acetylene resulted in a direct saving of $25.00 per day on the Magnolia Gas Company's welded line. Other savings, both direct and indirect, amounted to a great deal more.

Considering how the application of the welding process is growing so as to require larger and larger welding gangs, it is obvious

Welding a Joint—Acetylene Supply Line is Seen at the Right

that we should give a great deal of study to problems of the above nature in order to reduce the ultimate costs which are changeable to the use of the welding process.

M. KEITH DUNHAM, BACK FROM EUROPE, ANNOUNCES NEW FACTORY

M. Keith Dunham, Chicago, recently returned to this country, via the Leviathan, from an extensive business trip through Europe.

He announces the completion of his company's new acetylene cylinder plant, located at Milwaukee, Wis. This plant is now

View of M. Keith Dunham's New Cylinder Plant at Milwaukee

under production, manufacturing seamless cylinders which have monolithic fillers.

Mr. Dunham also announces the installation of a new oxygen plant at the Carbo-Oxygen Company, Bayou, New Jersey. This is the second of its kind to be installed there by his company. These units have a capacity of forty thousand feet of oxygen per day.

Concerning his sojourn abroad Mr. Dunham reports that welding, especially in Germany, has reached a higher development and more popular use than in this country.

W. M. Bastable, sales manager of the Wilson Welder and Metals Company, Hoboken, N. J., left last week for an extended business trip through the Island of Cuba.

An All-Welded Steel Ship

Seventy-Ton Oil Tanker Constructed As One-Piece Barge by Means of Electric Arc Process

WITH the launching at Providence of a one-piece steel tanker barge, welded throughout by the electric arc, may come the revolutionizing of one form of ship construction. This boat, built by the Saxe Providence Boiler Works, will be used by the Pennsylvania Petroleum Products Company for transporting oil between Fall River, Providence and New Bedford. It is the first electrically all-welded vessel of its kind constructed in this country.

This ship was entirely constructed by the electric arc welding method, using three General Electric welding equipments. One was used for tacking with a fitting up crew and the other two,

Fig. 1—Laying the Center Keels

for welding. The largest number of men used at one time was six. The builders estimate that, were the ship constructed in the ordinary riveting manner, a force of eighteen men would have been required. A further comparison, based on a record of costs and an estimate for the riveting process, is given below:

Riveting Process

Labor—18 men at an average of 80c per hour, 9-hour day	$129.60
Rivets—one keg per day	7.00
Running Cost of Air Compressor	5.00
Totals	$141.60

Welding Process

Labor—3 electric welders at 90c per hour, 9 hours	$24.30

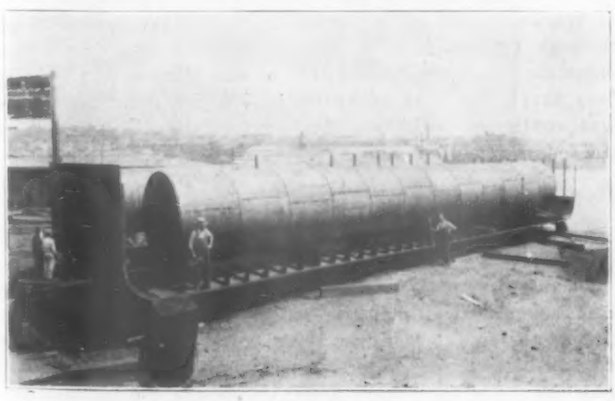


Fig. 2—The Two Tanks in Place

1 oxygen cutter and 8 fitting up men at 90c	24.30
Oxygen—500 ft. at 2c per foot	10.00
Acetylene gas—50 ft. at 4c per foot	2.00
Running cost of 1 gas-electric welder	5.00
Power for 2 motor-generator welders—50 K.W.H. per day at $.0746 per K.W.H.	3.73
Totals	$69.33

Note: Fuel and labor for rivet heating, laying out and punching have been left out, and are partly balanced by the cost of electrode material in the welding process. The labor item in the riveting figures includes riveting, chipping, caulking and bolting up.

Thus it will be seen that, excluding the costs common to both

Fig. 3—Uprights and Angle Frame-work Under Construction

processes, two electrically welded vessels could have been built for the price of one riveted boat.

The tanker is built around two cylindrical oil tanks eight feet in diameter and 67 feet long, each tank having a capacity of 26,000 gallons. The craft is 76 feet long, 21 feet wide and 11 feet deep, boat and tanks having a total weight of 70 tons. The barge is divided into four compartments with three watertight bulkheads. Oil will also be carried in the two middle sections of the hull around the outside of the tanks. The end sections will be reserved as bulkheads containing air for buoyancy purposes.

The watertight bulkheads are built around and welded to the cylindrical tanks, virtually making them part of the hull. Under

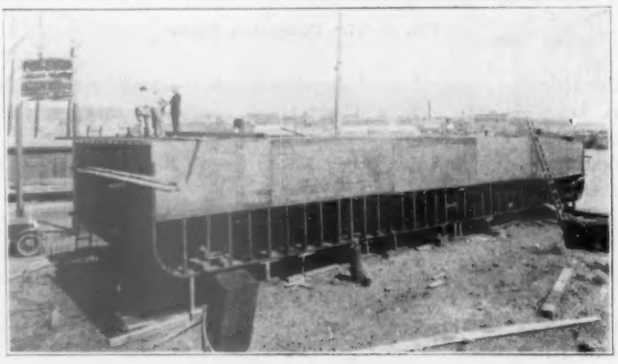


Fig. 4—Laying the Deck and Side Plates

the two tanks, running longitudinally, there are two keelsons 16 inches in depth with five double saddle foundations acting as cradles in which the tanks rest.

The shell of the barge is constructed of $\frac{3}{16}$-inch tank steel reinforced with 3x3x¼-inch angle iron ribs, spaced 22 inches apart. These form the frame of the boat. In each of the two end compartments, there is a center keelson 27 inches deep and, in the two middle compartments, there is a longitudinal bulkhead running from the keel to the deck. This practically acts as another keelson. The shell plates have a lap of six inches and these are welded both inside and out. The ribs are welded at an interval of eight inches, both on the toe and the heel side.

There are four manholes, 24 inches in diameter, running up through the deck from the tanks and fastened to the deck with all angle ring collar which is also welded. These act as expansion chambers, taking up any expansion which may occur in the oil.

Two guards run around the ship consisting of two angle irons 3x3 inches, welded to the ship and supporting a 6x8-inch pine timber, bolted to the hull. These guards act as bumpers when docking or when being towed.

Deck beams are constructed of 2x2x¼-inch angle iron braced down to the tanks with No. 10 deck plates, welded watertight. This prevents any washing of water into the hull. The deck house is located at the rear end of the boat, consisting of two rooms for one occupant, whose duty is to attend to hawsers, tow-lines, etc. The towing bits are located two at either end and are fastened to the tanks, thus avoiding any strain on the hull.

The Saxe Providence Boiler Works, who made the boat, have been engaged in the construction and repair of tanks for 14 years. In this work, they are now using electric welding almost exclusively.

When the plates for the bottom of the all-welded tanker were laid and the announcement made that the boat was to be built without rivets or bolts, many interested visitors came to inspect the job. The opinion among the seafaring elements was to the effect that the ship would break in two when launched. As the work progressed, however, and further visits were made,

Fig. 5—The Completed Barge

the attitudes changed until skepticism was replaced by enthusiasm. A keen interest has been expressed unofficially in government circles and Captain John Brooks, government hull inspector, states that this is the nearest approach to a non-sinkable ship he has ever seen.

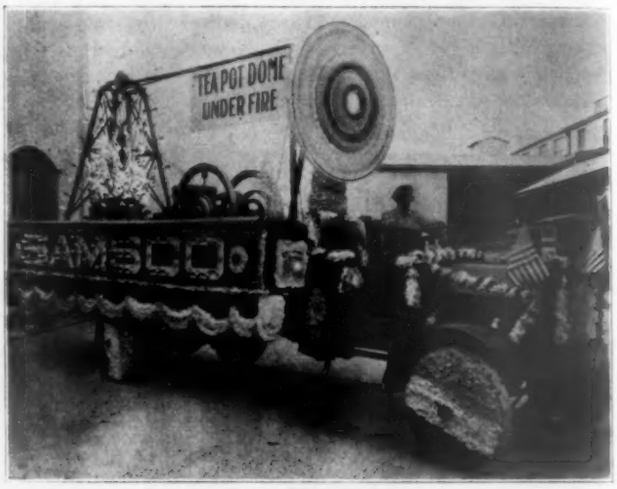
The boat was launched the first part of December, at the full of the moon, a time when the tides are high. This minimized the difficulty in getting the craft into the water from the high bank whereon it rested. The launching was effected in the Providence River and the tanker will be put into active operation immediately.

"TEAPOT DOME UNDER FIRE"

THE cutting torch recently played an important part in the winning of first prize in a novel float exposition presented to the public of San Antonio, Texas. On the day of the "Flower Battle" celebration, it is the custom in San Antonio for all first class firms and institutions to create a float exhibit and parade through the main streets of the city. First, second and third prizes are awarded by the judges to the most original and picturesque exhibition, and on this particular occasion first prize went to the San Antonio Machine & Supply Co., for their float, "Teapot Dome Under Fire."

The accompanying photograph shows a two ton truck bedecked with flowers which grow abundantly in and about the city of San Antonio. A gas engine manufactured by the San Antonio Machine & Supply Co. was mounted on this truck. To the left of the gas engine a sheet metal revolving dome was built and placed on the truck with a multitude of colored lights placed on it in rows about ten inches apart.

At night, when this dome with its many colored lights revolved it resembled very much the bottom of a fierce oil well under fire. Above this dome a derrick was built with all the accessories necessary to making it look like the real thing. This derrick was also highly illuminated so as to



Novel Float Using Oxy-acetylene Cutting Torch to Give Unusual Effect

give it the appearance of burning. To the right of the gas engine was mounted a fly wheel operated by the engine and was also covered with flowers and lights.

The main show was, of course, exhibited at night. The gas engine was started, turning the fly wheel and dome, and making sounds very similar to those heard near a burning oil well.

The dome was built large enough to accommodate a cutting operator underneath it. The operator was furnished with a couple of dozen flat steel bars and rods for cutting purposes. Above the dome a regular eight inch casing was placed. When the operator started to cut from beneath the dome the shower of sparks made by the oxy-acetylene cutting operation came through the casing in a roundabout form and then dropped down on the truck. The effect of this shower of sparks was very much like that of an oil well under fire. This cutting was continued with two torches and the display was considered the most ingenious ever offered to the public.

MEETING OF COMPRESSED GAS MANUFACTURERS

The Compressed Gas Manufacturers' Association, representing manufacturers of all industrial gases, will hold its twelfth annual meeting on January 26, at the Hotel Astor, New York. The meeting will be followed by the annual dinner on the evening of the same day. The association studies principally the technical problems involved in transportation of gases under pressure, methods of insuring the establishment of safe practices and the possibility of extending the uses of compressed gases in industry. John H. Luening, 120 West Forty-second Street, New York, is secretary of the association.

The Department of Labor, Washington, in a bulletin dated Dec. 14, 1924, reports increasing employment and generally improved conditions throughout the east and middle west.

Steel Wire Manufacture in Britain*

A Survey of Various Methods of Making Wire—Properties and Uses of Wire in the Welding Industry

By E. A. Atkins, M. I. Mech. E., M. I. W. E.†

AS steel wire is so extensively used in connection with welding processes and all kinds of allied work, it will be of interest to those associated with the welding and other industries to know something of the history of wire, its manufacture, and its particular properties.

Fig 1—Ancient Method of Wire-drawing

The earliest wire made by the use of the draw-plate was no doubt manufactured by main force in some such manner as indicated by Fig. 1. After this stage came the use of a form of hand machine by which the operator was able to exercise

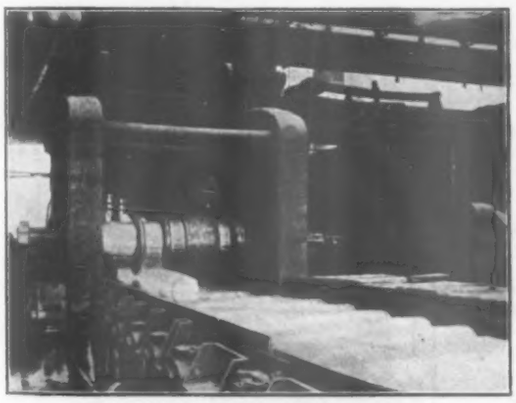


Fig. 2—Piling the Ingots

considerable leverage in pulling the wire through the draw-plate. It was then an easy stage to the application of power, the first kind used being that of water. Although it is not clearly established, it is fairly certain that this type of machine was first constructed at Nurnberg by a person named Ludolf, who kept it secret for some time and made a small fortune by the use of it. Nurnberg also gave birth to many subsequent improvements in the manufacture of various kinds of wire.

Wire-Drawing in Olden Times

It is possible that iron wire was manufactured about the middle of the fifteenth century in England, as at that period the importation of wire into England was prohibited. In 1565 is recorded the granting of patents to certain Dutchmen

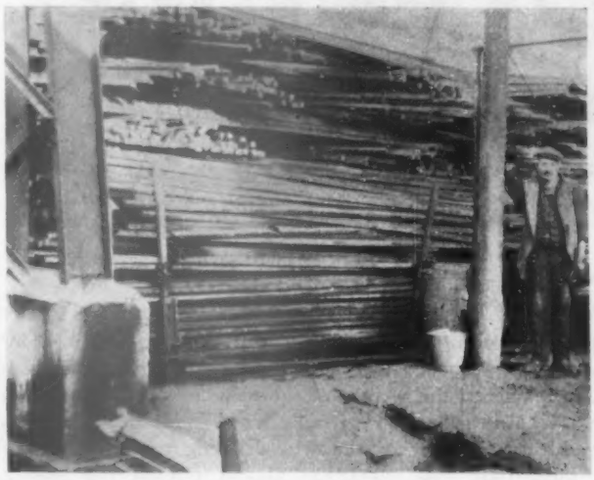


Fig. 3—Pile of Billets

or Germans for the prosecution in England of various manufacturers, among which is that of wire. Prior to that time all English iron wire appears to have been drawn by manual strength in the Forest of Dean and elsewhere.

By the year 1630 the manufacture seems to have made such

Fig. 4—Rolling Wire Rods

progress that in a proclamation of Charles I. it is alluded to as a manufacture of long standing and one which employed many thousands of persons, and also that the quality of the product was much better than that which came from foreign parts. The first wire-mill in England was set up at Sheen,

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* *Paper read before the members of the Institution of Welding Engineers, London, October, 1924.*

† *Directors of Research, Messrs. Rylands Brothers Limited, and Messrs. Pearson & Knowles, Ltd., Warrington., Lecturer on Welding, Municipal Technical School, Liverpool.*

near Richmond, by Dutchmen, in 1662. The wire-drawing business either followed cloth manufacture, or was determined by the approximate location of coal and iron, for it soon took deep root in the neighborhood of Barnsley in Yorkshire. Towards the end of the eighteenth century, the trade commenced at Warrington, the largest manufacturers there, Rylands Bros., Ltd., holding the unique record of having made wire for 120 years.

Fig. 5—Heap of Finished Rods

Modern Methods

When the rolling of bars came into use wrought iron for wire-drawing purposes was rolled down into rods of about ¼-in. in diameter, the weight of the piece usually being about 28 lb. The introduction of mild steel or ingot iron has changed the character of the wire-drawing trade, for, as in other industries, mild steel has almost pushed the use of wrought iron out of existence. With the exception of a little Swedish charcoal iron, wrought iron has almost ceased to be used in the making of wire. Mild steel is usually purer

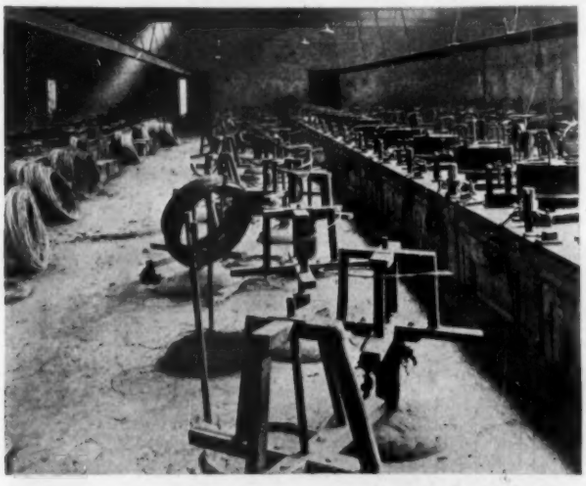

Fig. 6—Wire-drawing Mill

and more uniform in its composition than ordinary wrought iron, and consequently much heavier pieces can now be drawn than obtained in the old days.

While the raw product that comes into a wire works is the rolled rod from the steel mill, it is perhaps, as well for us to look back a little at the earlier stages through which the steel has to pass before it comes to the wire mill. The steel, of course, originally comes from the iron ore which is smelted in the blast furnace. After smelting, the hot metal passes to the steel furnace and is there purified. In this process its impurities—such as phosphorus, silicon, sulphur, etc.—are very largely removed. After being stripped from the mould the ingot is reheated or soaked, passed through the cogging mill, as shown by a photograph of the actual process of rolling taken at the Partington Steel Works (Fig. 2) and ultimately rolled down to billets of about two inches square as shown by a heap of the same (Fig. 3).

To produce the rods the billets are charged into a furnace and heated up to the required temperature, afterwards being passed through a continuous train of rolls and reduced down to about one-fifth of an inch in diameter. A photograph of the process, as carried on at the Pearson & Knowles' Iron

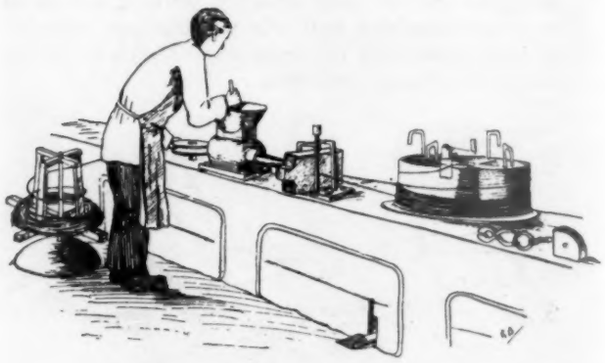

Fig. 7—Wire-drawer Operating Machine

and Steel Works, is shown in Fig. 4, and a heap of the resulting rods in Fig. 5.

Cleaning of Rods and Wire

One of the most important processes in connection with the making of wire is the proper cleaning of rods, so as to free them entirely from any form of scale, as this latter is fatal to

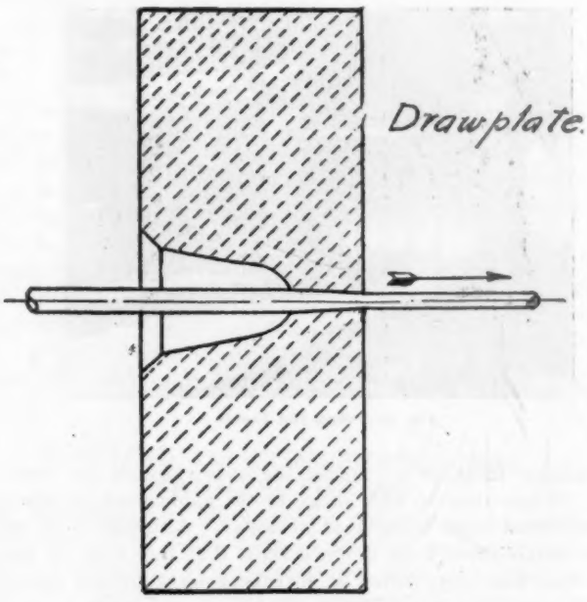

Fig. 8—Passing Wire Through Draw-plate

good wire-drawing. The general practice is to submerge the rods in cisterns of dilute hydrochloric acid until the whole of the scale has been completely "pickled" away. After cleaning in this form the rods are then washed well and allowed to stand until they are "browned" or coated with a film of ferric-hydrate. This "coating" of wire is exceedingly important and should be carried out with great care, as the subsequent drawing of the wire, especially for what is known as long-holing or carrying the wire to fine gauges, depends very largely upon the proper coating of the wire.

After coating, the rods are dipped into a vat of hot lime water, lifted out, and well dried in ovens. The thin coating of lime on the top of the ferric-hydrate serves the double purpose of protecting the brown coat and also of keeping the rod surface from corroding.

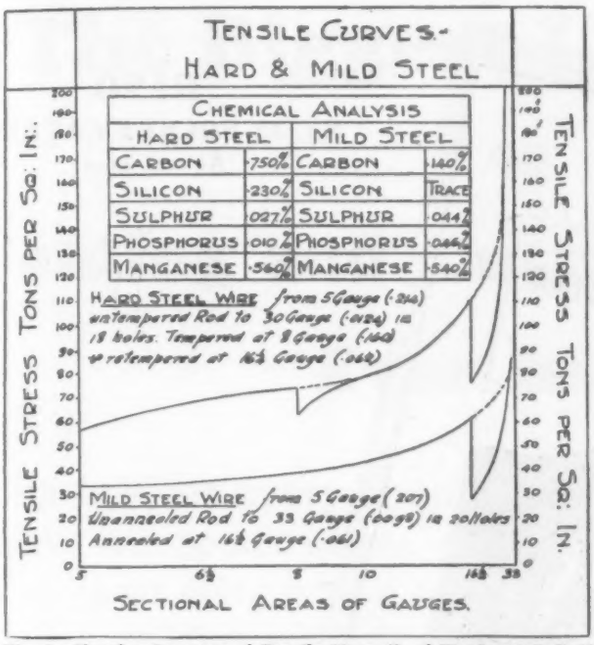
TENSILE CURVES-
HARD & MILD STEEL
CHEMICAL ANALYSIS
HARD STEEL
CARBON .750%
SILICON .230%
SULPHUR .027%
PHOSPHORUS .010%
MANGANESE .560%
MILD STEEL
CARBON .140%
SILICON TRACE
SULPHUR .044%
PHOSPHORUS .046%
MANGANESE .540%
HARD STEEL WIRE from 5 Gauge (.214) untempered Rod to 30 Gauge (.024) in 18 holes. Tempered at 8 Gauge (.160) & retempered at 16½ Gauge (.062)
MILD STEEL WIRE from 5 Gauge (.207) Unannealed Rod to 33 Gauge (.0098) in 20 holes Annealed at 16½ Gauge (.061)
TENSILE STRESS TONS PER SQ. IN.
TENSILE STRESS TONS PER SQ. IN.
SECTIONAL AREAS OF GAUGES.

Fig. 9—Showing Increase of Tensile Strength of Hard and Soft Steel Which Takes Place in Wire-drawing

Before either rods or wire can be passed through the draw-plate it is necessary that the ends should be pointed to a conical form. This was originally done by hammering or filing, or a combination of both. The bulk of the pointing at the present time is done by the aid of either rotary swaging

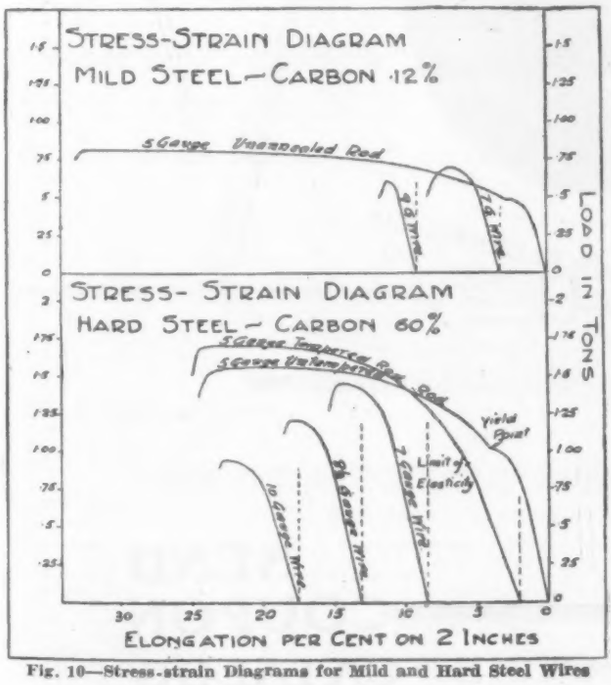

Fig. 10—Stress-strain Diagrams for Mild and Hard Steel Wires

machines or grooved rollers; in some cases other special mechanical devices are used for forming the point.

Methods of Wire-Drawing

There are two general processes in vogue—one known as the "dry" and the other as the "wet" method. In dry drawing, the rod or wire is passed through a draw-plate or die which has a tapered hole, the lubricant in this case being a special form of well-dried soap. In wet drawing, the wire or rod is first coated with a thin film of copper, the latter being deposited by passing the rod or wire through a special solution containing sulphate of copper. The wire then passes through a soapy solution and on through the hole of the draw-plate. This method of wire-drawing a hard metal within a shell or skin of a softer metal has been in use for more than a century and in practice gives very good results.

The rods as they come into the wire mill are usually in

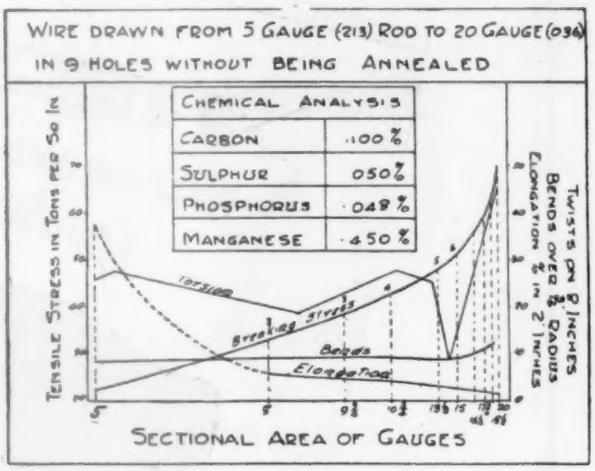

Fig. 11—Physical Properties of Wire at Various Gauges

pieces weighing about 150 lb. to 170 lb., which will give a length of about a quarter of a mile of 5-gauge. This, when drawn to 10-gauge, increases in length to about three-quarters of a mile. If drawn to 20 gauge its length works out to about nine miles, and then if drawn further to 30 gauge stretches to a length of 70 miles, or 280 times the length of the original rod.

A view of one of the wire-drawing mills at Warrington is shown in Fig. 6, in which swifts containing the rolled rod can be seen and also the draw-plate and the blocks, some of which

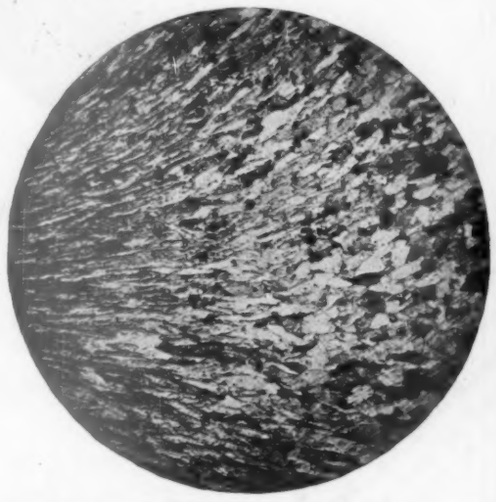

Fig. 12—Micro Photograph Showing Flow of Metal as Wire Passes Through Draw-plate

contained finished wire. The actual process of drawing is indicated in Fig. 7, on which will be seen the rod or wire passing through the soap box, the plate, and on to the block.

Science of Wire-Drawing

While the casual observer would think that the making of wire is a very simple process, which involves little knowl-

(*Continued on page* 39)

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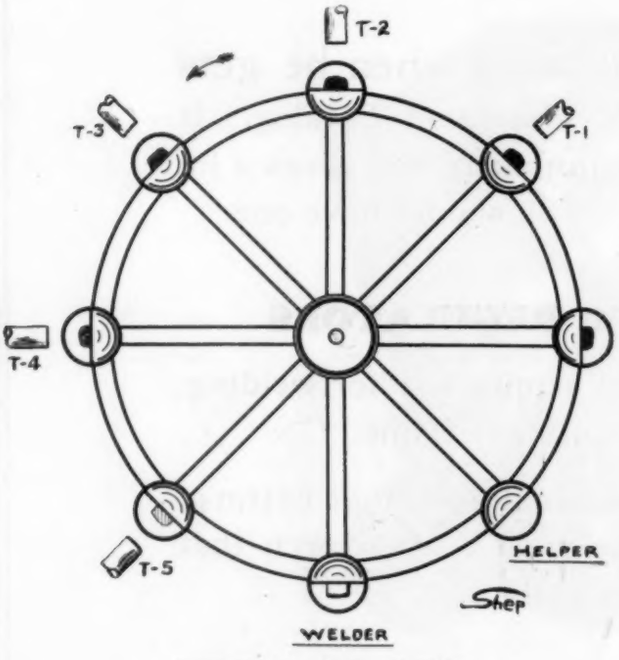
Cutting the Welding Cost

"Shep" Writes Again—His Sporting Blood Loses a Bet But Succeeds in Winning a Real Production Idea

London, England.

Dear Ed:

Suppose you are classing me among the "missing" by now. I don't blame you in the least. When so many months have rolled on without even a word, such action would only be natural. I've had one devil of a time, Ed, and I don't mind stating so here and now. It's bad enough roaming around in foreign lands when a fellow feels kipper but when you get downright sick; have no friends to call upon and to cap things off, lose all your money, it's anything but heaven. This all happened in Germany, but I'm in England now.



Ingenuity in Production Welding

London, as you appreciate, is the largest city in the world. Like New York, it is made up of small townships or boroughs, only much smaller. Some of these are only a few blocks square. There are no street cars in London proper. The busses and underground offer the only means of transportation. Yes! the busses and all street traffic still travel on the left hand side. There are not nearly as many automobiles here as in the U. S. A. This fact is so noticeable that the traveler immediately wonders why. After inquiring I found that it was not a lack of desire to ride in them, for the people here are just as anxious to own one as in our country, but apparently the government is against them. The taxes are placed so high that it discourages all but the rich. The taxes are based on the horsepower, and when you realize that the taxes on an ordinary Ford run between one hundred and a hundred and ten dollars per year, you can appreciate why the people hesitate about buying a car. As a result, the automobile industry in England is not considered a very important one. The tire (or tyre, as they spell it here), and all the allied industries are noticeably absent, as well as motoring highways, with spacious garages and filling stations.

On account of the fewer cars, there are not the large number of small welding shops and places doing welding that might be expected. It is only natural that a traveler should think of conditions in England, in much the same light as in America, but there is a difference. Before many shops or the mechanical world is reached you must leave London. In the suburbs there are a great many things of interest. I came across one application of welding that proved the most interesting of any encountered in a long while. It might be called a production proposition for it certainly enabled the operator to turn out more welds per hour than I ever thought possible, through manual operation. I came upon it in quite a peculiar way too. Fact is, if it hadn't been for a little sporting blood, the stunt would still be a secret. Here's how:

I was lunching with one of England's foremost authorities on oxy-acetylene welding and after enjoying some particularly good food, he dropped a remark about a certain plant doing some very advanced things in welding. Naturally, I pricked up my ears and asked more about it.

"What is the nature of the work?" I asked.

"Why most of it is repetition work, or as you might say, production of small parts."

"How does the procedure differ from the ordinary?" I went on.

"That is just the point," he answered. "While we all know they have a method all their own, none of us have ever been able to gain entrance to their shop to see just how their welding is done. They keep all of their methods very secret and no stranger or salesman is ever allowed in their plant."

"Perhaps I should not have mentioned this to you," he went on, "for naturally your curiosity will now be aroused, and while I feel confident that not only yourself, but all of us, would find this plant particularly interesting, I doubt very much if there is a chance in the world of seeing the inside."

Well, Ed, as you can imagine that certainly would arouse my curiosity, so nothing would satisfy me now until I saw the inside of that plant. I appreciated that it might be difficult and, therefore, some plan of action would have to be figured out.

I finally got an idea and that afternoon I left the city of London behind and dashed out to the small suburb where this plant was located.

Being an American, my rude entree without the formality of having written a letter requesting an interview, gave the manager no great shock. I found him to be a very fine fellow, and after chatting a bit about things in general I drew our conversation down to the welding industry. After a bit, I gave him some good stunts and ideas which I had picked up and knew would appeal to him in his line, and I could see that he received them in the spirit given and was very grateful. Carrying on along this line, the talk gradually drifted around to his own business and he showed me some of the samples of his work.

The opportunity I was looking for came quite unexpectedly. He was showing me one part and made the statement: "You would hardly believe that the welding of that particular part only takes ten seconds, or in orther words, one welder with one helper turns out six a minute."

"Ah!" I exclaimed, "but that would be impossible; begging your pardon, for the size of the piece would indicate that it would take almost a full minute to bring it to a welding heat. Surely, you must be mistaken."

"I thought that would arouse your interest," he commented, "just as it has those of our competitors. They all wonder how we can keep our cost down so low. Now you are an American," he continued, "and the Americans are noted for being good sportsmen. If you would like, I will be glad to wager you 'ten bob' that the statement made relative to their production is absolutely true."

Well, Ed, you know me. I took the wager figuring that the idea was certainly worth the price even if I did lose, and at the same time I was maintaining the impression that we good Americans have established abroad.

Naturally, I lost the wager, but I might add, that I saw the shop and there are some mighty interesting things in that shop. Unfortunately, I have been placed in a position where I am not at liberty to divulge the character of the work that they turned out, but I feel free to cite the reasons why I lost my bet. The little sketch which I have made out showing a rotary wheel with five city gas torches arranged to do preheating simultaneously is an idea which you will be quick to grasp.

As you will observe, this wheel has eight cup-like receptacles mounted at equal intervals around the circumference. A foot lever operated by the welder actuates this wheel so that it revolves one-eighth of its circumference every time the lever is operated. The helper removes the finished article and places on a new part. As this is revolved, it is played upon by the first preheating torch indicated in the sketch as T-1. The next revolution carries this part to torch T-2. From there it goes to T-3, T-4, and T-5. From this latter point it is placed in front of the welder, who applies his torch for approximately ten seconds, and completes his work. This is possible, because the part has reached a red heat, having been played upon for fifty seconds before reaching the welder.

You will grant that this is a mighty ingenious device and in production plants could be worked out to handle most any kind of job. If the work was large, the wheel could be made in proportion and the number and size of the preheating torches increased. If the work were small, the size of the wheel could be diminished. Whether the operation is welding or brazing, you can see the great possibilities.

Well, Ed, that's that! Guess I'll have to ring off, for the present. It seems like a month of Sundays since I heard from you, so for the love o'Mike drop me a line to the enclosed address and tell me all the scandal. In the meanwhile, I'm getting together a big bunch of new stuff to shoot you; all of which I expect to get around to shortly.

Here's hoping everything in the good old U. S. A. is "top hole."

As ever,

SHEP.

COMPRESSED AND LIQUIFIED GASES

Washington, D. C., January 13, 1925.—The Department of Commerce announces that, according to the data collected at the biennial census of manufacturers, 1923, compressed and liquefied gases to the value of $54,188,407 were manufactured during the year, an increase of 35.7 per cent as compared with $39,930,984 in 1921, and of 25.7 per cent as compared with $43,113,322 in 1919.

The production of the principal gases included in this group was as follows: Oxygen, 2,019,589,000 cubic feet, valued at $22,925,934, an increase in value of 64.2 per cent as compared with $13,964,952 in 1921; acetylene (not including acetylene distributed through mains), 522,349,000 cubic feet, valued at $13,080,232, an increase in value of 74.3 per cent as compared with $7,504,325 in 1921; anhydrous ammonia (not including production by gas companies), 11,765 short tons, valued at $6,414,667 an increase in value of 12.4 per cent as compared with $5,708,820 in 1921.

The statistics for 1923 and 1921 are summarized in the statement below. The figures for 1923 are preliminary and subject to such correction as may be found necessary upon further examination of the returns.

	1923	1921
Total value	$54,188,407	[a]$39,930,984
Acetylene[b]—		
Number of establishments	58	49
M Cu. ft.	522,349	290,854
Value	$13,080,232	$7,504,325
Hydrogen—		
Number of establishments	51	46
M cu. ft.	141,754	99,104
Value	$1,151,778	$639,553
Oxygen—		
Number of establishments	[c]121	94
M cu. ft.	2,019,589	1,059,825
Value	$22,925,934	$13,964,952
Anhydrous ammonia[d]—		
Number of establishments	12	[a]12
Tons (2,000 pounds)	11,765	[a]10,566
Value	$6,414,667	[a]$5.708,820
Carbon dioxide (carbonic acid)—		
Number of establishments	45	43
Tons	25,548	27,308
Value	$4,992,363	$6,374,619
Chlorine—		
Number of establishments	12	13
Tons	36,868	28,611
Value	$2,751,172	$3,188,750
Nitrous oxide (laughing gas)—		
Number of establishments	12	8
M gallons	45,267	42,016
Value	$730,644	$747,979
Other gases[e], value	$2,141,617	$1,801,986

A. The total value of products and the figures for anhydrous ammonia as here shown for 1921 differ from those heretofore published because of the inclusion in the previous reports and the noninclusion in this table of data showing the production, by 19 gas companies, of 3,253 tons of anhydrous ammonia valued at $489,851.

B. Not including acetylene distributed through mains.

C. Establishments using electrolytic method alone, 59; those using compression method alone, 57; those using both methods, 5.

D. Not including production by gas companies.

E. Sulphur trioxide, sulphur dioxide, carbohydrogen, argon, blau gas, nitrogen, etc.

GAS PRODUCTS ASSOCIATION CONVENTION

The Gas Products Association, the trade association of the oxy-acetylene industry, composed of producers of oxygen, hydrogen and acetylene gases, carbide, welding and cutting apparatus and supplies, will hold its eleventh mid-winter convention at the Hotel Sherman, Chicago, January 22, 23, and 24, 1925. The convention will close with a banquet on Saturday evening, January 25.

Convention headquarters will be the Hotel Sherman, Clark and Randolph Streets, and for members desiring to stop there the following rates have been offered:

Single room without bath	$2.50 and $3.00
Single room with bath	$3.50, $4.00, $4.50 and $5.00
Double room with bath	$6.00, $7.00 and $8.00

Reservations will be arranged for members intending to attend through the executive offices of the Association, 140 South Dearborn Street, Chicago. Charles T. Allen is Secretary and Treasurer.

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The Welding Engineer does not publish in its news or advertising columns any matter that deals with or refers to either personal or legal controversies.

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Torch Vs. Pipe Wrench

IN Germany the hurry call for the plumber sees him take his welding apparatus and rush to the scene. He, as a rule, does not bother with a wrench. The use of welding has done away with costly fittings, large stocks and innumerable tools. Especially is this true in the modern buildings, homes as well as other structures. The welded fittings have revolutionized plumbing over there. This is right, for is it not much easier to cut out a section of pipe and weld in a new one when a leak appears or a fitting is to be changed than it is to measure accurately, cut threads, carry a stock of elbows, tees and especially designed fittings, and go to many other troubles? In fact, nothing prevents the welding up of the leak, thus doing away with all the work. It is much easier, too, when a building is being equipped with plumbing and fixtures. Instead of measuring everything and being confined to a few standard ways of laying pipe, one can, with welding lay the pipe in any direction, make any turns, bends or joints desired just as easily as laying it straight. This saves a lot of time, labor and money, for many men and large stocks are unnecessary. Welding in the plumbing industry has been advocated here for quite some time but in Germany it is now the accepted process. Let's make it the rule over here too. Speed and at the same time efficient work of high quality is the standard in America. Welding will answer this requirement and also its qualifications.

What Are Eyes Worth?

TO watch the average helper around a welding shop, one would easily get the impression that his eyes were the very least of his worries. There the helper stands intently watching the work of the welder with usually no protection whatever for his eyes. Now let the helper take the torch in his own hands to do the job and he at once dons a pair of goggles. Such practice can hardly be termed protecting the eyes. The same harmful rays of light exist in the welding flame, in the case of acetylene welding, and in the arc, when electric welding, whether you are actually doing the work or not. In shops where the electric process is in general use this carelessness is not as often run upon as in the gas welding shops, doubtless because the glare of the arc is more brilliant than that of the torch. However, in both cases the ultra-violet and infra-red rays are present. These are the ones which cause trouble. The proper use of scientifically prepared goggles with lenses, which exclude these rays and yet allow the proper passage of the useful visible rays, is the objective to strive for. Every man who has welders under his supervision should see that they have proper eye protection. This, aside from being altruistic, is the efficient way of getting results from the welders on the job. Eyes are invaluable—protect them!

And Still There's Room

OIL burners are not new in the heating industry. They have been used to a certain extent for quite a few years. Now they are being used more and more. Almost every new bungalow and building shows a sign stating to those who care to read that a so-and-so oil burner system is being installed. In fact, these same signs are found in front of older buildings where the change is taking place. Again welding is coming into its own. Every oil burner system while waiting installation displays a huge tank, usually with brazen letters proclaiming its purpose. These tanks offer a wide field for welding in their manufacture and installation. Most installation crews have a welder who goes right along on the job to handle the welding as it comes up, while many other welders are employed in the shops fabricating the tanks. Apparently the application of welding is unlimited. A new use for it comes up every day. Keep your eyes open and when an opportunity to prove or demonstrate that welding is superior to some other process comes your way, step right out and show them that welding is always ready to meet the need.

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Fabricating Large Structures*

Welding Versus Riveting in Structural Work—Simpler Drawings Required—Use of Welding as a Substitute Method for Fabrication

H. Goldmark†, W. Spraragen††, and W. L. Warner†††.

PART I

THE various processes of fusion welding have received the especial attention of engineers throughout the world during the past five or six years. This attention has been necessitated by high costs of materials, delays in replacement of parts and in some cases the need for a superior product.

It was natural that the first uses of welding should be in places where no other method could be used, as for example in the repair of broken and damaged machine parts, repair of blow holes in faulty castings, building up of incorrectly machined or worn surfaces. Long delays in getting new parts and high replacement values made it absolutely necessary for engineers to give welding a tryout even though in some cases they did not have very much confidence in welding or were entirely unfamiliar with it.

The applications of welding rapidly doubled and trebled, but this increased use was also accompanied by some evils. Good welding requires proper materials, apparatus, methods and workmen. Certain scientific principles must be recognized if good results are to be obtained. Unfortunately, through ignorance or lack of responsibility some bad welding was done which has caused engineers to be cautious in specifying its use.

In special cases the advantages of welding in producing oil, water and gas-tight construction led to its use as a means of fabricating tanks, pipe lines, vessels and containers of all descriptions. Where methods were standardized remarkable savings and superiority of product were soon apparent as compared with similar riveted structures. Moreover, if properly done a welded joint could be made equal to the strength of the original material, whereas the riveted and caulked joints leaked below 50 per cent of their ultimate tensile strength, and sometimes as low as 25 per cent.

Welding versus Riveting in Structural Work

Unless, of course, it is possible to show advantages in using welding as compared with riveting in the fabrication of large structures, it is hardly to be expected that engineers and builders will abandon their present methods of riveting which have been found to give satisfactory results in service.

The many advantages of welding are well known to those who have been intimately associated with welding developments during the past few years. These people are, therefore, surprised that other engineers do not understand these advantages and possibilities. In some cases where the welding process is understood, there is considerable apprehension at the thought of abandoning present old and tried methods for something new. Also the question of scrapping machinery and equipment which have required large outlays of money is of considerable importance to the executive.

The two methods are radically different as to manufacturing processes. For example, the following steps are necessary in riveting a building or bridge:

1. Design.
2. Making the drawings.
3. Making templets.
4. Marking steel.
5. Punching or drilling holes.
6. Assembling.
7. Riveting.
8. Painting in the shop.
9. Erection.
10. Painting in the field.

Let us compare the steps involved in erecting the same bridge or building by welding, in which case they would be:

1. Design.
2. Making the drawings. (Much simpler as compared to riveting where each rivet must be shown.)
3. Preparing material to be welded. (In some instances this requires beveling of plates, in others removal of rust, and in still others no preparation at all.)
4. Erection.
5. Painting in the field.

These differences in methods of fabricating result in several inherent advantages in favor of the welding process.

Saving in Weights

Data from existing examples of this type of construction show that a saving of from 15 to 25 per cent in weight can be secured. The welded joint may easily be made as strong as the parts themselves while the corresponding riveted joint is rarely equal to 75 per cent of the strength of the parts. Moreover this saving in weight and increased efficiency can be secured by proper welding, and even the weight and cost of the rivets is very little less than the weight and cost of the welding wire.

The elastic features of the welding process commend it to this class of work especially. Sometimes the welded joint may necessarily be so situated that the weld as laid out by the draughtsman cannot be completely made, due to interference by other members, etc. In that case the weld may be shifted somewhat or an extra plate added without any appreciable delay or increased weight and cost. With a riveted member considerable time and cost would be necessitated in preparing an additional gusset plate and riveting it.

Simpler Drawings Required

With the riveted type of steel structure each rivet must be clearly indicated on the drawings, both with regard to size and position. Considerable attention must be given to laying out the joints so that the members will fit snugly together and yet allow proper clearance for driving rivets. Very often the expense of making these drawings is an appreciable part of the total cost. The drawings for a welded structure are much simpler as all rivets are eliminated and there are fewer details at the joints.

3. *Elimination of Certain Steps.* The following steps necessary in the shop for the riveted construction are eliminated when the welding processes are used: making templets, marking steel, punching or drilling holes and painting.

4. *Accurate Alignment Not Necessary.* In welding, parts need not be aligned as accurately as in riveting. In the latter

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*Presented at the Fall Meeting, A. W. S., Cleveland, Oct., 1924.

†Consulting Engineer.

††Secretary, American Bureau of Welding.

†††Industrial Engineering Department, General Electric Co.

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case it is frequently found that because of inaccuracies of workmanship, holes do not come exactly opposite, but by driving a drift pin the holes are more nearly brought in line and then reamed to get a smoother and larger hole before a rivet is driven. The piece to be riveted must be moved around in order to bring the rivet in the proper position in the riveting machine, or else the riveter is portable for use on heavy work and is so arranged that it could be moved about as the rivets are driven.

In outside construction the alignment of rivet holes and the driving of rivets is a slower and more tedious job. Perfect alignment is necessary before the rivets can be driven. With welded construction the members can be fitted in place and considerable freedom is allowed for making joints. If the piece being placed is too long an oxy-acetylene torch may be brought into play and the joint made. Often times members and plates may be cut to size with the oxy-acetylene torch and the parts welded together. The freedom allowed by the use of the process is one great advantage.

Fig. 1—Method Employed to Measure Modulus of Elasticity in English Tests

5. *Elimination of Noise.* The elimination of the noise of riveting may not seem of any consequence to the contractor, but undoubtedly he would be happier if his job could be quieter. The elimination of this noise is of the greatest importance to the public, especially in the big cities. Anyone who has been for a time in the proximity of a job where riveting was being done can appreciate the value of eliminating the noise and racket.

6. *Saving in Freight and Handling.* Because of the lesser weight of the material involved, freight and cartage charges will be considerably less.

7. *Superiority of Product.* Where oil, water or gas tightness is required the superiority of a welded product which is tight up to its ultimate strength commends itself as compared to a riveted structure which is only tight up to 50 per cent of its ultimate strength.

"Once tight always tight." That's the secret of good welding. In any steel structure there occurs inevitably a certain amount of movement due to impact of wind, expansion and contraction, etc. Riveted joints sometimes loosen slightly due to these forces, and in time unless repaired there will be trouble. A welded joint is solid and no movement can take place. The various members become in reality parts of each other and together make one integral whole.

8. *Economies.* A combination of all these factors makes it possible with the use of welding to produce a structure which is cheaper and better than the ones constructed by riveting. The designing is more easily and quickly done. The only shop work required is that for cutting gusset plates and members to the proper size. Assembly and erection are more easily and quickly done and there are few possibilities of delay caused by errors in laying out. The savings may amount to from 10 to 25 per cent of the total cost.

The Use of Welding as a Substitute Method for Fabrication

Before welding would be specified, structural engineers must be convinced that it is entirely safe for the purpose at hand.

Two kinds of tests are needed. Results obtained (1) in service from structures fabricated by the welding processes and (2) from laboratory tests where stresses will be introduced in specimens of the nature most likely to be met in service.

In England, on behalf of Lloyd's Register of Shipping, a number of large size specimens were welded. Specimens were machined to give a vee groove having a 60° opening the full depth of the plate. The welding was done in a horizontal position from the upper surface. It was found that the welding had completely penetrated the plates, no welding on the reverse side being necessary. The excess of weld was not trimmed off, except in a few cases, but was left rough as finished by the workmen, the weld being slightly above the surface of the plate to about the same extent as the point of an ordinary countersunk rivet.

Results of English Tests

Note: These English tests are so important that the conclusions derived from these tests are reproduced below. Complete test results and description of specimens are included in a paper presented by Mr. W. S. Abell on application of Electric Welding to Large Structures, published before the Institution of Civil Engineers.—1921.

1. Modulus of Elasticity and Approximate Elastic Limit

(a) In the welded plate the extensions in the region of the weld are sensibly the same as for more distant portions of the unwelded plate. (See Figs. 1 and 2.)

(b) With small welded specimens containing an appreciable proportion of welded material in the cross-sectional area, the relation between extension and stress is practically the same, up to the elastic limit, as for similar unwelded material.

(c) The elastic limit (or the limiting stress beyond which extension is not approximately directly proportional to stress) appears to be slightly higher in welded than in unwelded material.

(d) The modulus of elasticity of a small test-piece, entirely composed of material of the weld, was about 11,700 tons per square inch, as compared with about 13,500 tons for mild steel and about 12,500 tons for wrought iron.

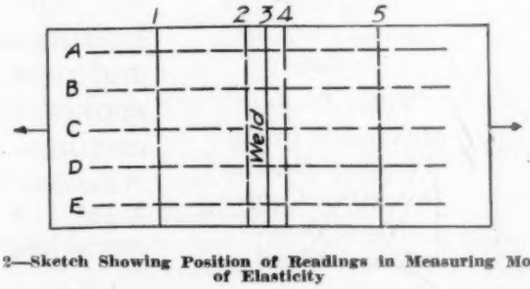

Fig. 2—Sketch Showing Position of Readings in Measuring Modulus of Elasticity

2. Ultimate Strength and Ultimate Elongation

(a) The ultimate strength of welded material with small specimens was more than 100 per cent of the strength of the unwelded steel plate for thicknesses of ½ inch, and averaged 90 per cent for plates ¾ and 1 inch in thickness.

(b) Up to the point of fracture the extensions of the welded specimens are not sensibly different from those of similar unwelded material.

(c) At stresses greater than the elastic limit the welded material is less ductile than mild steel, and the ultimate

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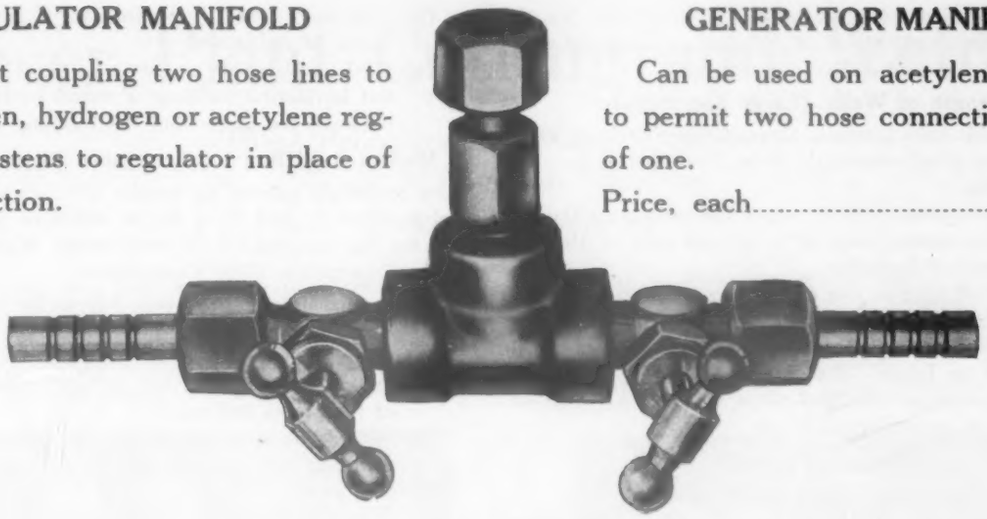
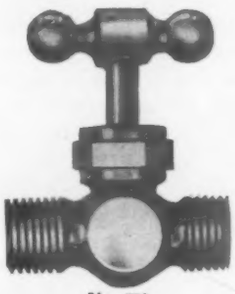


TORCH VALVES



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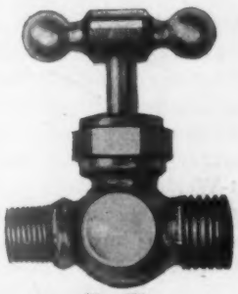

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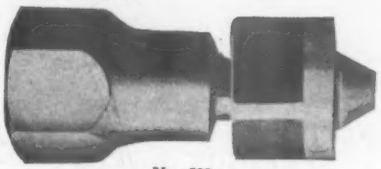

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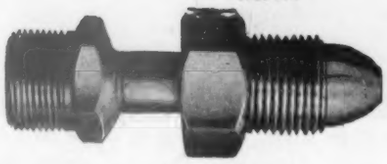

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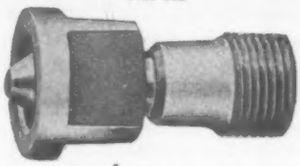

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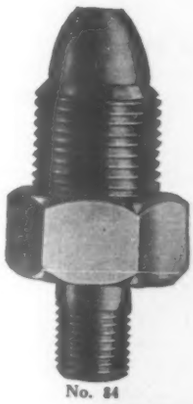
CYLINDER CONNECTIONS



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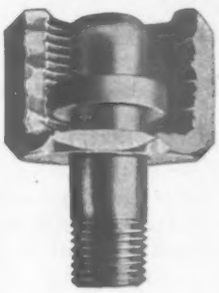

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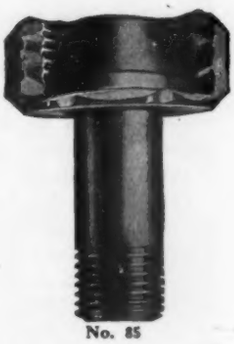

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elongation of a welded specimen, when measured on a length of 8 inches, averages only about 10 per cent, as compared with 25 to 30 per cent for mild steel.

3. Strength of Welds (Large Specimens)

(a) Butt Welds have a tensile strength varying from 90 to 95 per cent of the tensile strength of the unwelded plate.

(b) Lap Welds.

(1) With full fillets on both edges the ultimate strength in tension varies from 70 to 80 per cent of that of the unwelded materials.

(2) With a full fillet on one edge and a single run of weld on the other edge the results are very little inferior to those where a full fillet is provided for both edges.

(c) Riveted Lap Joints.—For plates of about ½-inch in thickness, the specimens averaged about 65 to 70 per cent of the strength of the unperforated plate.

4. Alternating Stresses

(a) Rotating Specimens (round bar).

(1) Unwelded turned bars will withstand a very large number of repetitions of stress (exceeding, say, five millions) when the range of stress is not greater than from 10½ tons per square inch tension to 10½ tons per square inch compression.

(2) Welded bars similarly tested will fail at about the same number of repetitions when the range of stress does not exceed ± 6½ tons per square inch.

(b) Stationary Test Pieces (flat plate).

(1) Butt-Welded specimens will withstand for a large number of repetitions about 70 per cent of the stress which can be borne by an unwelded plate.

(2) Lap-welded* plates can endure for a large number of repetitions about 60 per cent of the stress which can be withstood by a lap-riveted specimen.

5. Minor Tests

(a) Welded specimens are not capable of being bent (without fracture) over the prescribed radius to more than about 80 deg. with ¼-in. plate, reducing to some 20 deg. where the thickness is 1 in. Unwelded material under the same conditions can be bent through 180 deg.

(b) Welded plates can withstand impact with a considerable degree of success; a 1-in. plate of dimensions already quoted sustained two successive blows of 4 cwt. dropped through 12 ft., giving a deflection of 12 in. on a length of about 4 ft. 6 in., without any signs of fracture in the weld.

6. Chemical and Microscopic Analysis

(a) Chemical Analysis.

(1) The electrode was practically identical with mild steel, but there was a higher percentage of silicon.

(2) The material of the weld after deposition was ascertained to be practically pure iron, the various other contents being carbon 0.03, silicon 0.02, phosphorus 0.02 and manganese 0.04 per cent respectively.

(b) Microscopic Examination.

(1) The material of the weld is practically pure iron.

(2) The local influence of heat does not appear to affect largely the surrounding material, the structure not being much disturbed at about $\frac{1}{16}$-in. from the edge of the weld. The amount of disturbance is still less in thin plates.

(3) The weld bears little evidence, if any, of the occurrence of oxidation.

(4) With welds made as for these experiments, i. e., with flat horizontal welding, a sound junction is obtained between the plates and the welding material.

*NOTE—*The conclusions drawn as to the relative merits of lap welded and lap riveted seams in resisting alternating stresses are in the opinion of the authors not justified. It seems that the British investigators used a type of machine which gave a certain deflection for a particular test. It does not necessarily follow, however, that the forces necessary to cause this deflection would be the same for the lap welded and the lap riveted joints. In fact it is well known that the welded joints are the stiffer of the two and therefore a considerable additional force must have been required to cause the same deflection in the welded joint. This is particularly true after there was some giving in the rivets.*

Welded Steel Box for Emergency Fleet Corporation

The following interesting results were obtained on a large steel box, 12 ft. x 9 ft. x 10 ft., made of ½-in. tank steel plate for the information of the Electric Welding Committee of the Emergency Fleet Corporation.

The principal data to be obtained from the construction and testing of this box were:

(1) Could a structure of this character be bulit close to drawing dimensions and without excessive distortion of the plates and parts?

(2) Would the structure be strong and capable of withstanding severe shocks and distortions without serious ruptures?

(3) What would be the detail costs and time required to build such a structure?

The entire box was electrically arc welded, no rivets being used in its construction. The box was subjected to alternate applications of 15-lb. internal hydrostatic pressure and 22-in. vacuum more than 200 times and did not develop any serious leaks or failures in the welds. These results show that the condition (2) is satisfied to a considerable degree.

The cost of work done on the box was as follows:

Cost of welding	$ 151.28
Fabricating and assembling	157.94
Preliminary testing	50.00
Welding wire	30.00
Material	651.30
Total cost	$1,040.52

(To Be Continued)

GAS INDUSTRIES TO CONTEST INCREASE OF FREIGHT RATES

The Southern Classification Committee has recently announced a proposal to raise freight rates on shipments of compressed gases and the return of empty containers, to be effective within the geographic boundaries administered by this committee.

The proposal provides for a change of l. c. l. rates on compressed gases from fifth class to third class, and a change from sixth class to fourth class on returned containers. In many cases this means an increase of fifty per cent in the shipping costs of manufacturers.

Measures are being taken by associations and concerns in the industry to contest this increase. Hearings on the proposal have been set for January 13 in New York, January 21 in Chicago, and January 26 in Atlanta. The Compressed Gas Manufacturers' Association and the Gas Products Associations in addition to various other interested parties, are taking unified action to oppose the proposed changes of the Southern Classification Committee. Both of the above mentioned associations will be represented in the New York and Chicago hearings.

GAS COMPANIES DO RECORD-BREAKING BUSINESS IN 1924

The gas utilities of the United States sold 405 billion cubic feet of manufactured gas in 1924, according to figures made public by the American Gas Association. This is an increase of 20 billion cubic feet over 1923, and a six-year increase of 100 billion cubic feet.

The Air Reduction Sales Company, New York City, is reported to be planning the establishment of a branch plant at Lebanon, Pa.

Power Plant Cutting and Welding*

These Processes Have Great Utility and Wide Application Wherever Power Is Generated

MANY articles have been written pointing out the various applications of the oxy-acetylene process in power plants. From the boilers to the prime-movers and even beyond there are many, many places where in the maintenance and fabrication of equipment the blowpipe can be used to great economical advantage. The alteration of boiler furnace front plates, the repair of doors and stoker mechanism, and fabrication and repair of pipe lines, hangers and accessories, and repairs of the prime-movers themselves are all commonplace occurrences. But there are still further applications, some which even the chief engineer, long familiar with the oxy-acetylene process, may have overlooked. It is impossible to list them all because such applications are numerous and more or less dependent upon local conditions. To indicate this class of apparently obscure but nevertheless economical applications the following examples found in a fairly large industrial plant are given:

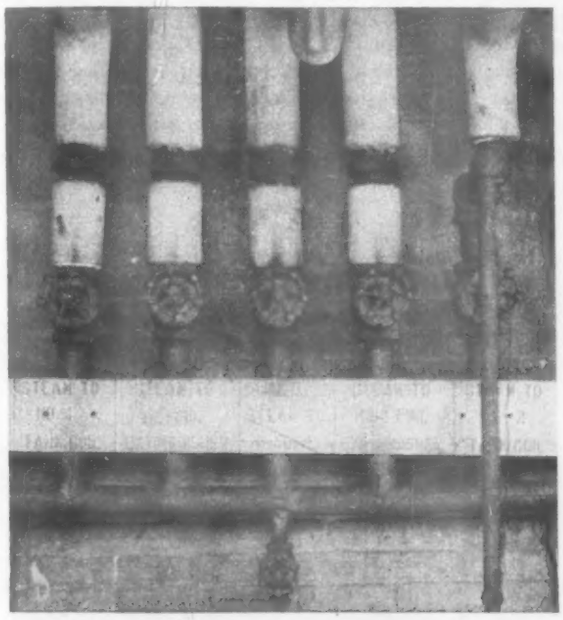

Fig. 1—Really a Steam Switchboard

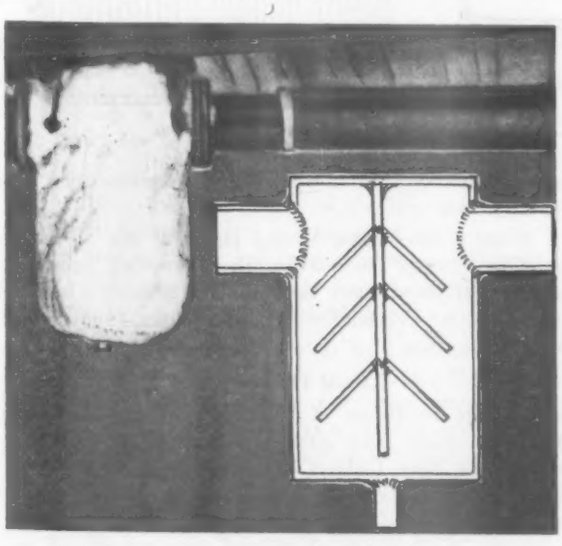

Fig. 2—Made in the Plant's Welding Shop

Header

Fig. 1 illustrates a header and its connections—really a switchboard from which the steam to two solvent pumps, two fire pumps, and two tank-heating coils is controlled. To throw steam into any one of these six lines it is merely necessary to open the center valve labeled "Main steam line to header," then open the valve of the line desired.

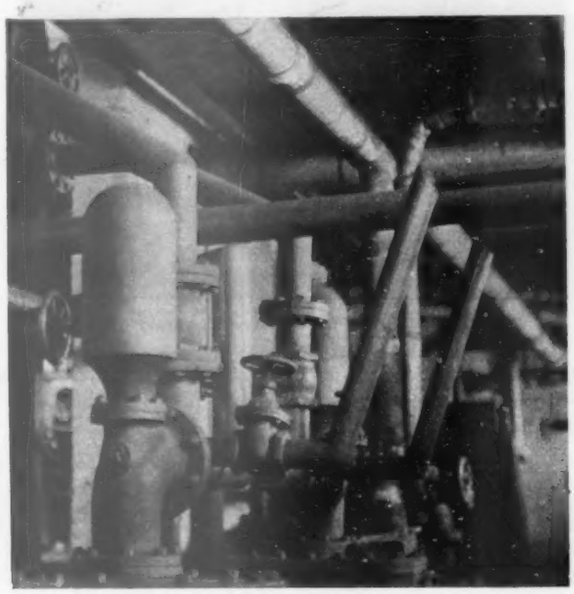

Fig. 3—The Bridge is Particularly Interesting

Fig. 4—Few Flanges are Left

This header was entirely fabricated by means of the oxy-acetylene process. The procedure follows: After the seven lines were brought down to the desired location and temporarily held in place, a piece of standard pipe of the same diameter as the

main steam line and sufficiently long to span them all was cut to length with the cutting blow-pipe. Then the nipples to fit the lines were cut and threaded. Next, the unthreaded ends of these nipples were cupped to fit the contour of the header. Using them as patterns the holes were cut in the larger pipe. Then

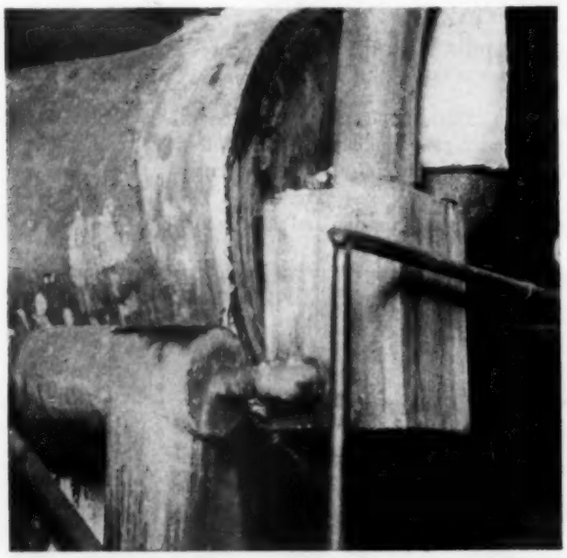

Fig. 5—Baffle Boxes Were Necessary

the header was clamped to an old I-beam (to prevent warpage) and the seven upper nipples welded in place. In finishing the header, discs of steel plate were cut and welded in the ends.

Steam Trap

To insure fairly dry steam at points some distance from the boilers, especially where a line passes from one building to another, a steam trap at a low point in the line is a necessity. Traps made of cast iron are available from supply houses, but besides being heavy bulky arrangements are quite costly.

Fig. 2 shows in sectional detail a trap that was made in the plant's welding shop. Instead of cast iron it was made from

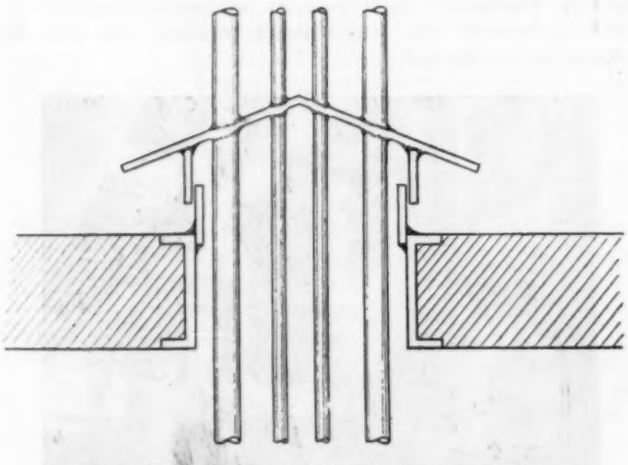

Fig. 6—The Arrangement Permits Free Expansion

steel. To make such a trap for a 4-in. line, for instance, a piece of 6-in. standard pipe was cut 18 in. long. Then two diametrically opposite holes were cut near one end (top of trap) and 4-in. nipples welded in. The bottom of the trap was closed with a disc cut from ¼-in. boiler plate and welded in. A nipple and gate valve for blowing off condensate and sediment was then welded in a hole cut in this bottom. Next, a vertical baffle 16 in. long and of a width equal to the inside diameter of the trap was cut from ¼-in. boiler plate. Semicircular fins were then cut from some scrap sheet and welded to the vertical baffle pointing downward at an angle of 45 deg. Finally, a disc was cut to close the top of the trap, the vertical baffle welded to it along the disc's diameter, slipped in place, and the top welded down. The finished trap was then put into the line by removing a piece from the latter with a cutting blowpipe, and welding two joints, one at each 4-in. nipple. This trap cost about $12.00, and it is lighter and just as efficient as a costly one of cast iron.

Pipe Repairs

This plant now does most of its pipe work by weldings. Of course, some of the original piping was connected by means of flanged joints. Few of these are left now, however, because as soon as one begins to leak that line is shut off, the flange cut out bodily with a cutting blowpipe and a spacer welded in its place.

This brings up the point of permanence. Some think a length of pipe cannot be changed if it is welded. But this is a fallacy. A cutting blowpipe will make two cuts quicker than two flanges can be unbolted. Then a new length can be welded into place in a shorter time than that necessary to cut two threads, screws or flanges and bolt up. Furthermore, in repairing a line with the aid of blowpipes it is merely necessary to cut out the bad section and not to take down a whole length as when using flanged or coupled joints.

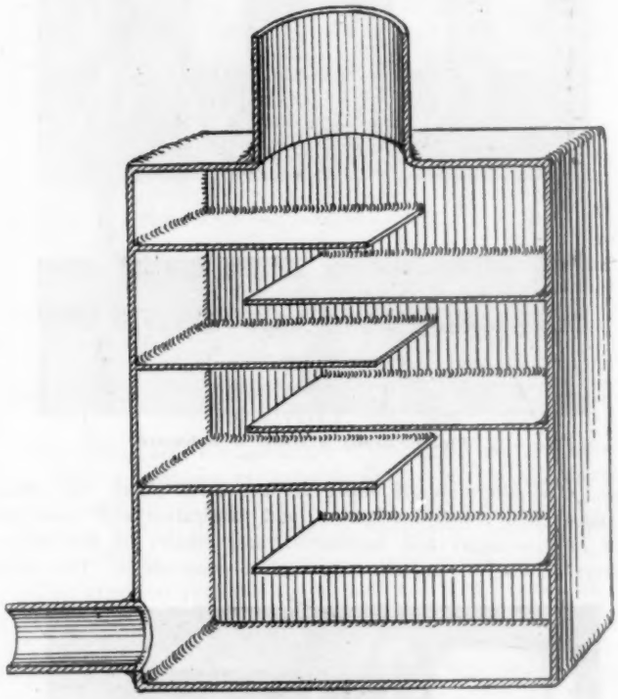

Fig. 7—How They Appear Inside

Figs. 3 and 4 show some welded piping in one of the pump rooms. The "bridge" is particularly interesting because this simple expedient saved many bumps on the engineer's head without buying special U-bends to carry these lines from the pumps across the passageway.

Roof Openings

Another quite novel use of welding is shown in the sketch Fig. 5. It is usually quite difficult to maintain a weather-proof seal when steam lines (subject of course to expansion) are run through a roof. Particularly is this true in pump houses with reinforced concrete roofs. But the problem was solved as the sketch shows. Four pieces of channel were mitred and welded together to form a rectangle with flanges out. This was built into the concrete roof after another frame of bent bar was welded to its inside edge. Then a sheet steel umbrella was made with a flanged edge which would make a sliding fit over the bar frame. Finally, holes to pass the pipes were cut in the

umbrella, which was then slipped over the pipes and welded to them. Completed, the arrangement permits free expansion of the pipes and still maintains a weather-proof roof.

Oil Separators

Welding was also used in making separators to recover engine oil from condensate. Baffle boxes were necessary to eliminate any pulsation which might take place in such a separator, due to the "puffing" exhaust transmitted through the condenser. Fig. 6 is a photograph of condenser, baffle box, and separator. Fig. 7 shows the baffle box to be nothing more than a rectangular welded sheet steel box and containing horizontal baffles alternately welded to opposite sides, a large nipple welded in the top and a small one in one side near the bottom.

The oil separator consists of two pieces of large diameter standard pipe welded together, the short one forming the top of the "T." Nipples are placed in both ends of the horizontal branch for inlet of the mixture and the overflow of the oil. From the bottom of the vertical a smaller vertical pipe extends upward and overflows at a slightly lower elevation than the other. This separator works on the principle that the height of liquid columns in the legs of a "U" tube are inversely proportional to the density of the liquids in the respective legs.

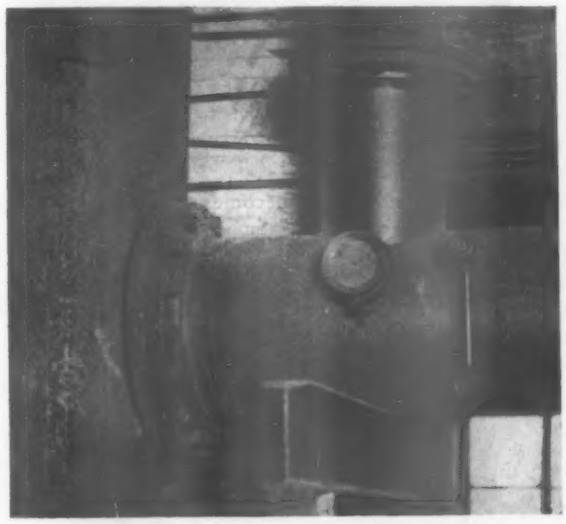

Fig. 8—Was Made in About an Hour

Fig. 8 shows a 17-in. by 20-in. "T" for the steam inlet to a barometric condenser (shown on the left). This "T" was made in about an hour to replace a heavy cast fitting which had cracked.

From the foregoing it can readily be seen that the oxy-acetylene process is not limited to one or two applications in the power plant. It is used on repair and fabrication jobs. When in doubt, remember: "Wherever metal is to be cut or joined the oxy-acetylene process can be used to advantage."

But there is also another thing to be remembered. A weld in any pressure system must be a good weld. For this reason the large plant which maintains its own boiler shop will do well to allot a corner of that for use as a central welding shop and employ a competent welding foreman under whom other welders may be trained until their work is uniformly good. The small plant, on the other hand, may find it more economical to let one of their mechanics take care of all welding except that on the pressure system, and then call in experienced men from a contract welding shop when a steam line or anything of such nature is to be repaired, altered or installed. In other words, welding on pressure systems should be accorded the same care, rigid inspection and testing that a steam boiler receives.

STEEL WIRE MANUFACTURE IN BRITAIN

(*Continued from page* 25)

edge or skill, in actual practice to obtain the best results a great amount of consideration has to be bestowed on the kind of dies used, the shape of hole, speed of drawing, method of lubrication and many other points that affect not only the drawing of the wire, but its ultimate quality.

Careful experiment and calculation show that the steel in passing through the wire-drawers' plate (Fig. 8), is subjected

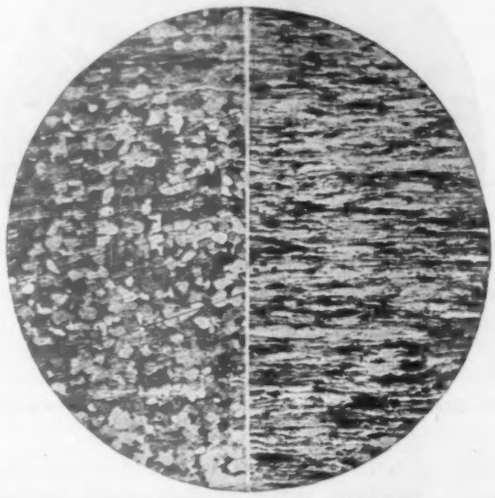

Fig. 13—Micro Photograph Showing Both Annealed Wire and Resulting Drawn Wire Structures

to an enormous pressure, this in some cases amounting to as much as 150 tons to the square inch. With such great pressure on the shoulder of the tapered hole in the draw-plate it is manifest that a solid or semi-solid lubricant must be used in wire-drawing. The commonest lubricant employed is the best olive oil soap, dried hard.

It is essential in wire-drawing that there should never be metallic contact between the surface of the wire and the sur-

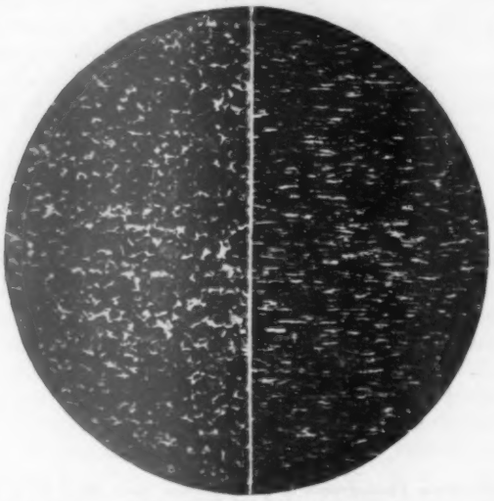

Fig. 14—Micro Photograph Showing Structure of Untempered 5 Gauge Rod and Resulting 10 Gauge Wire

face of the hole in the draw-plate, as this causes the wire to scrape and wear out the hole in the plate, producing unsizeable wire. The arrangements for lubricating must be such that a film of the hard soap travels on the surface of the wire and keeps it from coming into contact with the surface of the hole in the plate.

The speed at which wire travels through a draw-plate varies according to the diameter and quality of the material to be

produced. For soft steel this speed may run up to 1,000 ft. per minute. The reduction of area per draft varies according to the quality of steel being drawn and the kind of wire required. It may run up to 40 per cent and down to as low as 10 per cent.

The physical properties of steel are altered as it passes through the wire-drawing process, the chief alteration being a

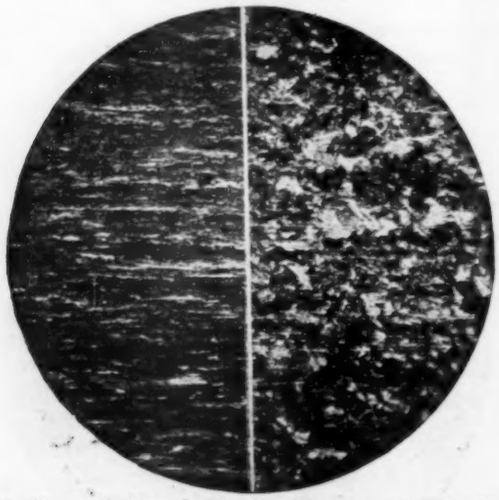

Fig. 15—Micro Photograph Showing Structure of Tempered Rods and Resulting 10 Gauge Wire

rapid increase in its tensile strength, and a reduction in its elongation. The curves shown (Fig. 9) exhibit the changes in the tensile strength of both hard and mild steel wires, having the respective chemical compositions given on the diagram. It will be seen that a No. 5 gauge rod (.212 in.) of .14 per cent carbon steel, as it comes from the rolling mill, has a tensile strength of about 33 tons per square inch. In drawing down to 16½ gauge its tensile strength has risen to about 62 tons per square inch. This, again, after annealing, when drawn down to 33 gauge, mounts up to about 85 tons per square inch. The .75 per cent carbon steel starts with a 5 gauge untempered rod, having a tensile strength of about 57

Fig. 16—Micro Photograph of Low Carbon Steel Wire to a Magnification of 100 Diameters

tons per square inch, but when drawn down to 33 gauge, with two intermediate temperings, it runs up to the extraordinary strength of 200 tons per square inch.

Stress-strain diagrams for mild and hard steel wire taken on a 10-ton Buckton testing machine are shown in Fig. 10. The chief characteristic observed in the mild steel diagram is the great reduction in the elongation as the wire is reduced in diameter. In the curves for hard steel it will be noticed that the untempered rod shows a definite yield point, but in the tempered rod it will be observed that no yield point is shown on the curve. This is not only true for tempered rod, but taking the curves for drawn wire on both the diagrams it will be seen that there is no clearly defined yield point. Also, it should be noticed that it is not easy exactly to define the limit of elasticity in any of the cases shown. Strictly speaking, however, the limit of elasticity should be at the

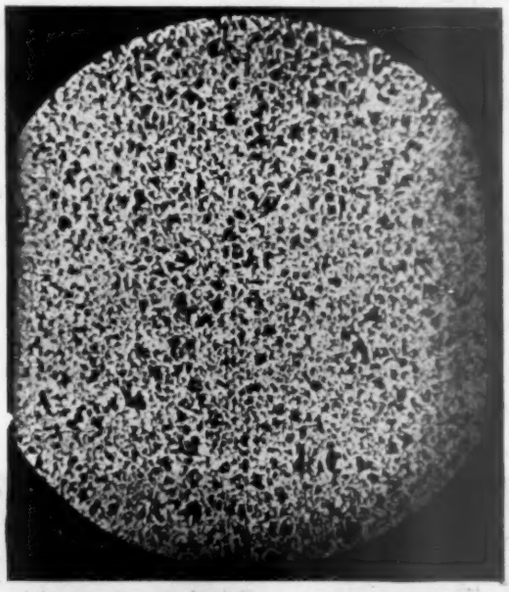

Fig. 17—Micro Photograph of High Carbon Steel Wire to a Magnification of 100 Diameters

point where the straight line becomes tangential to the curves as shown in the No. 5 gauge tempered rod.

The diagram, Fig. 11, shows the variation which takes place in all the physical properties of wire as it is being reduced by light holing. It will be observed that the property of torsion is very erratic. Indeed, in connection with all classes of wire there is no physical property upon which so little reliance can be placed as that of twisting, as it seems to be a measure of

Fig. 18—Micro Photograph of Steel Wire, Showing Heavy Sulphide Inclusions to a Magnification of 100 Diameters

no other physical condition of the steel but its own, and this varies so considerably under all kinds of treatment of the steel that in itself it appears to be of very little use for practical purposes.

The diagram also shows the extraordinary fall in the property of elongation as the wire is being reduced from the rod.

Under the Microscope

The use of the microscope plays an important part in connection with wire-drawing, as it enables us to see what is

happening as the steel passes through the plate, and also places the wire manufacturer in the position of being able to tell the quality of materials which give him the best results in wire-drawing, and to understand the cause of certain peculiar phenomena which sometimes occur in connection with the various processes.

It need not be explained in these days of advanced knowledge that mild steel is composed of a vast number of crystal grains, which can be readily detected under the microscope, and as the steel passes through the hole in the wire-drawer's plate, the grains are crushed and elongated, as seen in the micro-photograph (Fig. 12), this being to the magnification of 100 diameters, the actual size of the part photographed being just about equal to the size of the full stops on this page. The micro-photograph is also interesting as showing just what takes place when pressure is applied to a metal and solid flow results.

Fig. 13 (at the left of the photograph) shows the micro-structure of an annealed mild steel wire (also to a magnification of 100 diameters) before drawing, and the same photograph (on the right hand) shows how the structure has altered when the wire has been drawn down to a final size. The left half of Fig. 14 shows the structure of a hard steel untempered rod (of about 0.65 carbon), and the right-hand half shows the micro-structure of the same rod when drawn to 10-gauge wire.

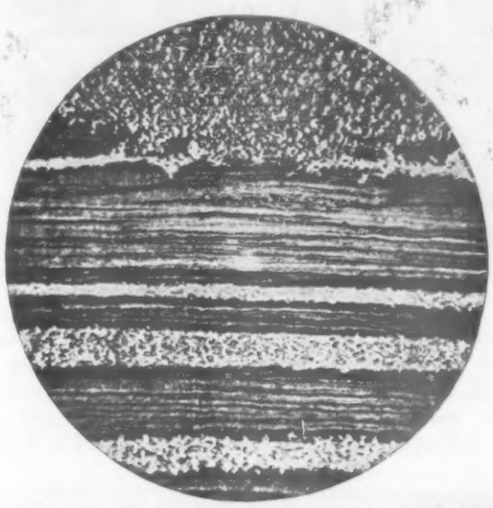

Fig. 19—Micro Photograph of Steel Wire Showing High Phosphorus Segregation

As showing the difference between a tempered and untempered rod, the left half of Fig. 15 should be compared with the left-hand portion of Fig. 14. From this it will be seen that the tempered structure shown on Fig. 15 is altogether different from that shown on Fig. 14. The micro-structure of the 10 gauge wire produced from the tempered rod is shown on the right-hand half of Fig. 15.

With variation of carbon and variation of heat treatment extraordinary wide limits can be obtained in the physical properties of wire, but this part of the subject would form a complete paper in itself. The latter is also true with regard to wire used as a filling material for acetylene and electric welding. For general welding purposes a low carbon steel having a structure as shown in Fig. 16 will give good results.

Troubles met with in the use of welding wire are many. Sparking and porous welds may be due to too much carbon in the steel, and this is shown by the pronounced black areas in Fig. 17, which is a definite indication that the carbon content of this particular steel is considerably higher than the one having the micro structure shown by Fig. 16.

The quantity of sulphur and distribution of same in a steel wire will cause sputtering. Where the sulphur runs up to no more than .04—.05 per cent and is well distributed in the steel, no very marked inconvenience is experienced in welding, but where the sulphur is in the form of globules of manganese sulphide, as shown in Fig. 18, minor forms of explosions will take place as the wire is melted down.

High phosphorus in a feed wire is certainly not only detrimental to the running down of the wire, but also in the resulting deposit. When it is segregated in steel, as shown in the micro photograph Fig. 19, this again will cause sputtering on account of the bands or threads of the high phosphorus material melting down much more quickly than the remaining portion of the steel.

More might be said with regard to welding wires, but as the paper is of a general character sufficient has been stated to indicate the necessity of the use of good welding wire if the best results in welding are to be obtained.

(The Welding Engineer acknowledges the kindness of the author and Messrs. Rylands Bros. for use of the cuts and illustrations.)

FLUX FEEDING ATTACHMENT FOR TORCHES

Fred H. Simmons, Hannibal, Mo., has just secured a patent on a flux bellows blower for gas torches. The device consists of a bellows attachment of heavy and durable material, which is secured to the upper part of the torch by means of a special clamp, arranged on the right hand side and designed to fit any size of torch. The bellows is operated by means of a bar in handy access to the thumb of the operating hand. The flux is forced through a feed pipe to the point of welding.

Flux Bellows Blower for Gas Torches

The inventor has endeavored to make possible continuous work, eliminating the delay of dipping metal or adding flux, and maintains that two years of experimenting in actual use has shown the blower to be a saver of time and gas, as well as of flux. The bellows are constructed so as to give sufficient force to prevent the flux being blown away by the gas flame.

SOLVING CHEMICAL PROBLEMS OF MANUFACTURERS

There is an organized effort of a trade association to help the average manufacturer solve his chemical problems. This will be brought about by the Chemical Equipment Manufacturers in an important show, covering twenty-three processes, in Providence. The first Chemical Equipment Exposition will be held June 22nd to 27th inclusive, 1925. The general public will not be admitted, for the show is for technical men, general executives, purchasing executives, superintendents, laboratory and operating men, owners, etc. It is to be made a medium for the exchange of both technical and practical manufacturing information. Headquarters of this association are at 1328 Broadway, New York City, and additional information may be obtained there.

WELFEX BOOKLET

The Chemical Treatment Company, 26 Broadway, New York City, has just issued a ten-page booklet describing its iron or steel welding flux, known by the trade name of Welfex. In addition to listing lot prices of the article, the catalogue also gives directions for the proper use of the flux.

Electric Welding of Pipe

Steel Mill Constructs Sixteen Hundred Feet of Exhaust Line by Means of this Process

By R. K. Randall*

A LARGE steel mill recently decided to use the exhaust steam from their blooming mill engine and from the steam hammers in their blacksmith shop. The exhaust steam is to be used as a pre-heating agent for the water used in their boilers. After a careful study had been made of various methods of pipe line construction, it was decided to use the electric arc welding process.

The line consisted of 800 feet of 30 inch, 400 feet of 24 inch, 350 feet of 28-inch and 65 feet of 48-inch pipe. The pipe was

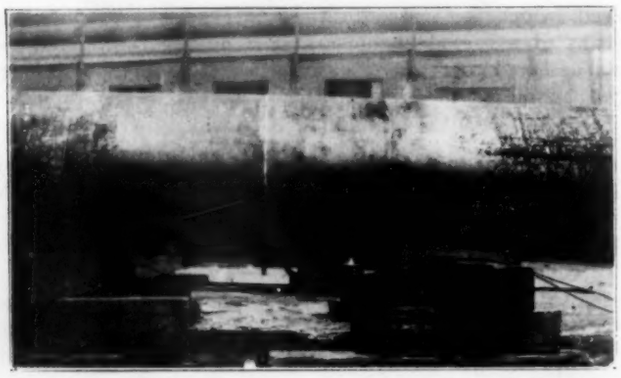

Fig. 1—Butt Weld Joining Two of the Thirty Foot Sections

National Tube Hammerweld, $\frac{5}{16}$ inches thick, and came in 30-foot lengths.

In taking into consideration the reasons for using hammerweld pipe and electric welding, these points stand out. First, Hammerweld pipe was cheaper than riveted; secondly, the use of

Fig. 2—Welding the Flange to the Pipe

welded joints greatly reduced the number of flanged joints thus reducing weight, and expense of flanges and bolts; third, it made it possible to reduce the diameter of entire line 2 inches as the internal friction caused by rivet heads was eliminated; fourth, in a rivet line all joints would have to be caulked in order to make the line tight and the constant expansion and contraction would tend to continually "start" the caulked edges, thus necessitating constant caulking to keep the line steam-tight; fifth, the appearance of the welded line would be much better and lagging could be applied in a more economical way. It can be readily seen that the five foregoing arguments should be enough to convince the average firm considering installing piped lines of any size that welding is the ideal method of pipe fabrication.

The line was started by butt welding two sections together as shown in Fig. 1. The pipe was leveled and set up on blocks to assure alignment. As the welds were made the pipe was rotated and overhead welding eliminated wherever possible. The pipe was welded into 90-foot sections. At each end of these sections a flange was welded on. Fig. 2 shows a flange being welded to the end of the pipe while on the ground. The welds were made in small sections at a time to reduce contraction strains and keep the faces of the flanges in alignment. The flanges themselves were made of 4 inch x 4 inch x ¾ inch angle iron, cut into length with the acetylene torch, then heated and bent to shape in the blacksmith shop, and then the butts electrically welded and faced. A good view of these flanges can be obtained by glancing at Fig. 3. Forty-two of these

Fig 3—The Welding Unit Mounted on Wheeled Carriage—Note Flanges in Foreground

Fig. 4—Ninety Foot Sections Ready for Erection

Welding Instructor, Cleveland Y. M. C. A. School of Technology.

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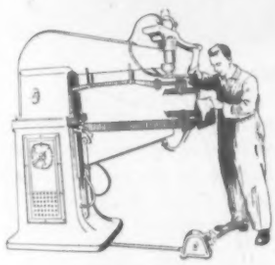

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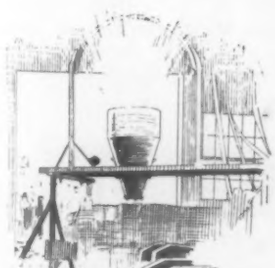

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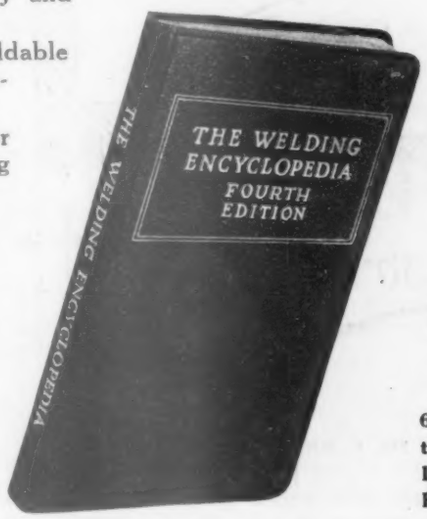

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flanges were used. A few sections of pipe all welded and ready for final erection are shown in Fig. 4. After being welded on the ground, the 90-foot sections of pipe were hoisted into position with a steam crane and secured.

The straight line welds offered no particular problems but the bends were more difficult to make. The templates used were made in the drawing office on hard fibre paper in half sections, these being used to mark pipes for cutting. In order to make the alignments of the bends easier the flanges were just slipped over the ends of the pipe, then the pipe was raised into position in the air. The flanges were then bolted together and welded to the pipe. This made it a very simple matter to get perfect

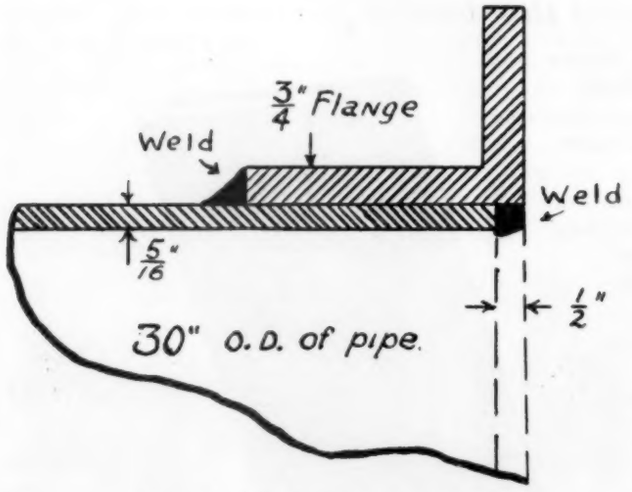


Fig. 5—Method of Welding Flanges

fits. The flanges were welded inside and out. Fig. 5 shows the method of welding the flanges. The welding on these flanges, in some cases 50 feet above ground, required the services of expert welders, as practically 50% of the work on them was overhead. See Fig. 1.

In addition to the butts and flanges welded there was much miscellaneous welding done, such as 15 28-inch saddles for manholes, and also a large number of standard pipe saddles.

Another interesting part of this job was the steam reservoir 48 inches in diameter and 65 feet high, shown in Fig. 6. This

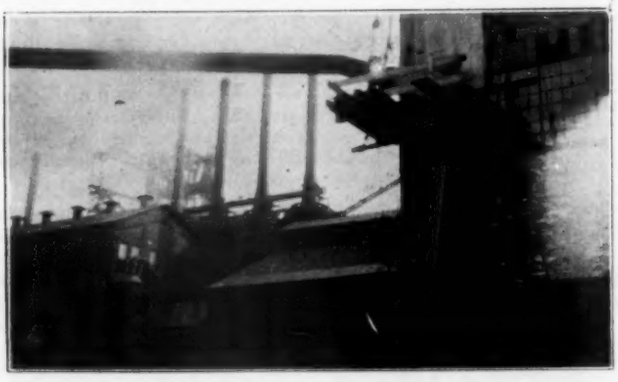


Fig. 6—Welding the Steam Reservoir

reservoir was welded on the ground so that it could be turned as the welding progressed, and then lifted into an upright position by steam cranes.

Two-sized electrodes were used on the job, 5/32 inches dia. being used for the pipe butt welds, and $\frac{3}{16}$ inches dia. for the flanges.

The average time on a circular joint of 30-inch pipe was 2 hours, on the 28-inch pipe 1 hour 50 minutes, and on the 24-inch pipe 1½ hours. Average time on the 48-inch reservoir seams was 4½ hours. This time is more or less approximate as no effort was made to get accurate data.

The machine used was of the dynamotor type weighing 500 lbs. Fig. 3 shows the machine mounted on standard "Ford" auto wheels. This mounting made it possible to move the machine quickly and easily from one section to another.

Fig. 7 shows a section of line in place. Note the riveted line several feet below. Although this picture does not show it, an 18-inch line is to be supported from the welded line.

This line proved absolutely tight and the steam tests showed no defective welds or leaks caused through carelessness of operators. Special attention was given to every inch of welding so as to secure perfect penetration and fusion.

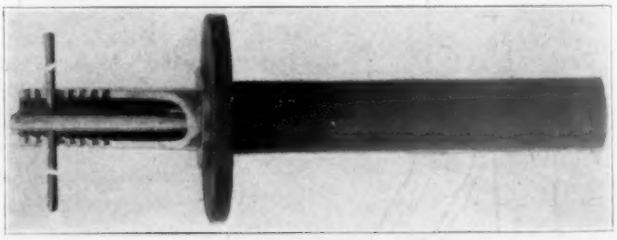
It seems right to mention here that the welders who contracted the job (there were two of them) were both old hands and proved once again that the "human element" plays a most important part in successful welding.

Fig. 7—Section of Line in Place Fifty Feet Above Ground

Most of the welded lines today are in the ground or between walls so that the average person has little or no chance to see them. This particular line being 50 feet up in the air will stand as a monument to welding and issue its challenge to all who see it that welding is without a doubt the best method known today for joining pipe.

NEW ELECTRODE HOLDER

A new type of welding electrode holder has been marketed by the General Electric Company, designed so as to allow welding operators to make a quick change from burnt stub to new elec-



New GE Welding Electrode Holders

trode. The operator needs only to strike the stub end of the old electrode, causing it to drop out, when the new wire can be inserted instantly without unnecessary effort.

The new holder consists of a punched fibre with a tinned brass plug inserted in the end. A steel spring rod holds the electrode in place against one of a number of different sized notches provided for the purpose. The welding cable running to the source of power is soldered to the other end of the holder by removing the fibre tube and fibre guard, accomplished by loosening a single screw.

The construction of this holder is intended to prevent the contact of the electrode being weakened by heat, since it does not depend upon any heat-affected spring.

News of the Welding Trade

John Heller, for a long time one of the directors of the International Oxygen Company, has been appointed sales manager for that company.

Henry W. Darling, for more than 30 years treasurer of the General Electric Company, resigned on January 1. In accepting his resignation the board of directors elected Mr. Darling a vice-president of the company. Mr. Darling has been connected with the General Electric Company since its organization in 1892. He is to be succeeded by R. S. Murray, who has also been connected with the company since 1893, and has been assistant treasurer since 1910.

The William Cramp & Sons Ship & Engine Building Co., Philadelphia, has been awarded a $6,565,000 contract by the American-Hawaiian Steamship Co., to build a twin-screw express passenger steamship. The vessel will have a speed of 22 knots and will be driven by geared turbines. She will have a length of 582 ft., a beam of 83 ft. and about 20,000 tons displacement. About 10,000 tons of steel will be required.

O. M. Bostwick, New York representative of the publicity department, General Electric Co., and formerly advertising manager of the Sprague Electric Works, has tendered his resignation, to take effect Jan 1. After a short vacation Mr. Bostwick will resume activities in the technical publicity field in New York.

The Pheonix Utility Company has awarded to the William Cramp & Sons Ship and Engine Building Company a contract for two 21,500-horsepower vertical I. P. Morris turbines complete with governors and auxiliaries for installation in the Cutler plant of the Utah Power & Light Corporation.

Messer and Company, of Frankfort, Germany, are constructing a new oxygen plant which is nearing completion. When finished the building will be over five hundred feet long, and will be one of the largest and most modern of its kind in Europe.

H. W. Hill has been appointed general superintendent of the acetylene plants of the Air Reduction Company, Inc. Mr. Hill is located in the New York office of the company and will report to R. A. Sossong, manager of Airco gas plants.

Mr. C. Moody, formerly manager of the Auto Lite Gas Co., Ltd., of Winnipeg, Canada, has joined the apparatus factory organization of the Purox Company at Los Angeles, Calif., as assistant manager. Mr. Moody brings to the Purox Company a fund of experience and technical knowledge concerning not only welding and cutting apparatus, but also concerning the manufacture of acetylene.

K-G Welding & Cutting Company, Inc., New York City, announces the signing of a contract with the Sutton-Garten Company of Indianapolis. This company will act as distributors of the K-G Welding & Cutting Company and will sell their products in Indianapolis and the adjacent territory.

Total exports of the United States for the first 11 months of 1924 aggregated $4,145,726,294, according to figures of the Department of Commerce. This is an increase of $404,898,733 over the $3,740,827,561 for the first 11 months of last year, and is almost equivalent to the $4,167,493,080 representing the entire outgoing movement for 1923. Exports exceeded imports by $869,053,327, or almost four times as much as in 1923.

The Burke Electric Company, Erie, Pa., announces that the sales force of their Cleveland office, located at 7829 Euclid Avenue, which is in charge of Mr. L. L. Myers, has been increased by the appointment of Mr. O. P. Hanchette. Mr. Hanchette is a practical welding engineer and he will specialize on the sale of electric arc welding equipment and as well handle the engineering service in connection with it.

The Air Reduction Sales Company has established a new acetylene distributing point at Warehouse No. 122, American Brokerage and Warehouse Co., 207 West First Street, Charlotte, N. C. This warehouse has hitherto handled oxygen only.

Two new acetylene plants of the Purox Company, Denver Colorado, are nearing completion. One of these is located at Los Angeles and the other at Oakland, California. These plants are part of the company's program of extending its acetylene supply to Pacific Coast customers.

The Pennsylvania Railroad Co., Philadelphia, is now making plans for the erection of a new engine house. This will be located at Altoona, Pa., where they have recently acquired a tract of 90 acres. The present engine house will be destroyed and a new repair shop constructed. Reported cost of this improvement is more than $100,000.

The Thomson Electric Welding Co., 161 Pleasant Street, Lynn, Mass., has recently awarded a general contract for a one-story addition to their plant.

Wilson Welder and Metals Co., Inc., Wilson Building, Hoboken, N. J., has recently added an arc welding machine to its line. This new machine is known as the type S, and is intended for production and repair service in foundries, steel mills, railroad and other shops. The machine is of the motor generator type, for single operator and has a range of adjustment from 75 to 250 amperes by small steps. This is a portable outfit.

The John A. Roeblings Sons' Co., 646 Folsom Street, San Francisco, manufacturer of wire rope, cables, etc., will take bids at once for its two-story factory branch and distributing plant, 200x400 ft., estimated to cost $250,000 with equipment. Frederick W. Quandt, Humboldt Bank Building, is architect, Headquarters are at Trenton, N. J.

The Sand Springs Railway Co., Sand Springs, Okla., has preliminary plans for rebuilding its car repair and machine shop and car barn, recently destroyed by fire. Additional machinery will be installed. C. O. Tingley is chief engineer.

George Clarke has just retired as general manager of the Kensington Shipyard department of the William Cramp & Sons Ship & Engine Building Co. of Philadelphia. Mr. Clarke will be succeeded by Mr. Howard Fisher.

The year's biggest passenger steamer contract has been awarded to the William Cramp & Sons Ship & Engine Building Co. of Philadelphia by the new Matson line. This is a passenger ship and the price is $6,560,000. The vessel will be named the Malolo, the Hawaiian word for flying fish.

The Pressed Steel Tank Co., Milwaukee, manufacturer of steel barrels, drums and other containers, acetylene cylinders, annealing pots, pressure tanks, etc., has issued $500,000 first (closed) mortgage serial gold bonds, the proceeds to be used to facilitate the enlargement of production and business generally. The plant is situated in West Allis and consists of six acres with buildings of 200,000 sq. ft. of floor space. Fixed assets were appraised March 15, 1924, at $1,257,535. Herman O. Brumder is president.

The Manganese Steel Forge Co., Philadelphia, Pa., has recently placed contracts for specially designed and built wire drawing machinery for drawing Rol-Man Manganese Steel wire for use as welding rods. This company expects to have the new wire drawing department in operation the latter part of January. The new department will be in charge of an expert wire drawer familiar with drawing manganese and other special wires for welding purposes. It is thought to be the only wire drawing plant in this country specially built and equipped for drawing manganese steel wire.

The San Gabriel Sheet Metal Works, San Gabriel, Cal., organized to manufacture sheet metal products, has started operations in a small way and contemplates building a plant soon. It is now in the market for conductors, elbows, gutters, mitres, etc. Some equipment is needed also for immediate needs. G. A. Whitman is one of the heads.

F. A. Merrick now vice-president and general manager of the Canadian Westinghouse company, has been elected vice-president and general manager of the Westinghouse Electric and Manufacturing Company, effective as of January 1, 1925.

Francis C. Pratt, vice-president in charge of engineering of the General Electric Co., Schenectady, N. Y., will fill the vacancy caused by the resignation of G. E. Emmons, as vice-president in charge of manufacturing and chairman of the manufacturing committee. Mr. Pratt's new title will be vice-president in charge of engineering and manufacturing. H. F. T. Erben has been appointed assistant vice-president on the staff of Mr. Pratt. He will continue as vice-chairman of the manufacturing committee. Mr. Pratt's engineering assistant is E. W. Allen, appointed to the position of manager of the engineering department in April, 1924.

Construction is in progress on a new wire and rod unit at the Sparrows Point, Md., property of the Bethlehem Steel Corporation, for the production of rods and complete line of wire products, including plain and galvanized wire, wire fencing, nails, etc. It is established that the plant will have a capacity of 120,000 tons annually and will employ a force of about 600 men.

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C. B. & Q. BUYS WELDING EQUIPMENT

The Chicago Burlington and Quincy Railroad recently placed an order with the General Electric Company for forty-five portable arc welders. These are to be put in use in the Railroad's erecting shops and engine houses.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
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Position Wanted:—As Oxy-acetylene sales and welding engineer; eight years' experience, past eighteen months as demonstrator and instructor with large concern; resigning January 15; one year chemical engineering; eastern territory preferred. Address Welding Engineer, No. 44.

Position Wanted—Oxy-acetylene welder, seven years' experience with all forms of gas welding; also some arc experience. Address Welding Engineer, No. 45.

For Sale—Property and business, fully equipped electric and acetylene welding, radiator, and general repair shop. For particulars write James M. Thompson, 114 Fifth Street, Monessen, Pa.

Opportunity for man with good personality and good experience in general as active partner and business drummer in the Welding and Radiator Work. Modern equipped plant, excellent location, established 1914. Address Leo Kappertz, 95 Washington Street, Morristown, New Jersey.

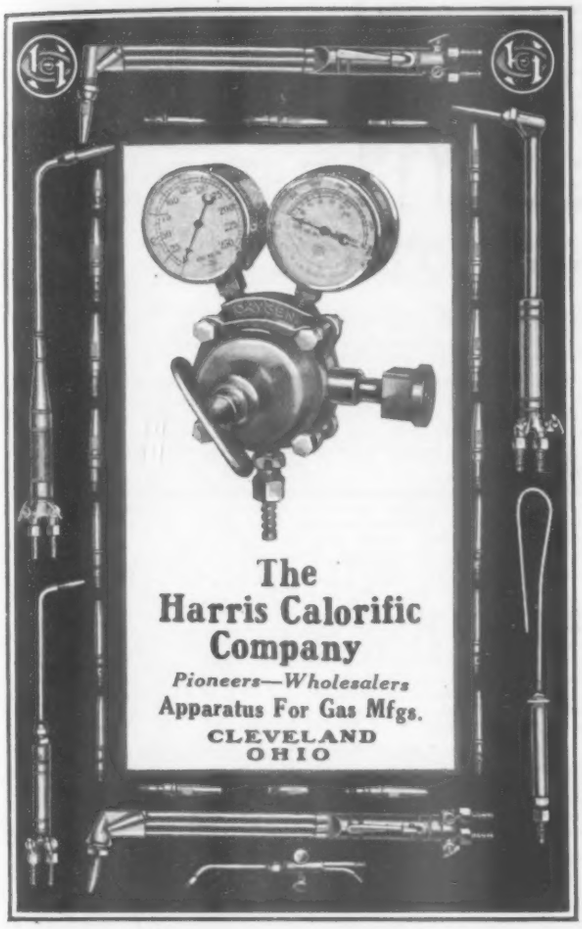
Position Wanted—Welder with 7 years' experience on both gas and electric cutting and welding would like to make permanent connections, in or near Chicago preferred. Address Jos. Shinkus, 917 West 31st Place, Chicago, Ill. Phone Yards 5335.

For Sale—One 100-lb. Duplex Oxweld Generator—Eight Flash Back Chambers—Five W-3 and one W-1 Oxweld Torches—Eight Regulating Valves. Above equipment in good condition. Address The Fuller Brush Company, 1080 Windsor Avenue, Hartford, Connecticut.

Position Wanted—Acetylene welder of 9 years' experience in Railroad, Factory and Private Shop desires to make a change. Capable of foremanship. References furnished. Address A. W. Young, 811 Trimble Ave., Kalamazoo, Mich.

For Sale—Established oxy-acetylene and Electric welding, and radiator repair shop in an agricultural community. Owner engaged in other work. Address Lester Linn, Rocky Ford, Colo.

Position Wanted—Electric and oxy-acetylene welder with previous experience in Navy Yard, wishes to make permanent connection. Welding was learned in the Rahe School of Kansas City. Previous experience has covered work on the Rock Island lines as well as in the Navy Yards. Address Geromino Tobbilos, care Col. Morix, Navy Yard, Mare Island, Calif.



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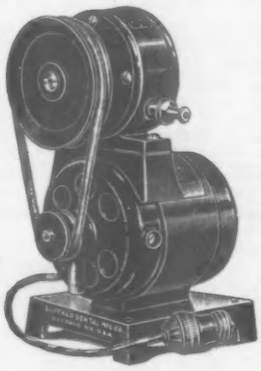

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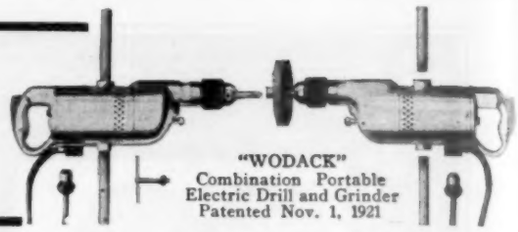
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CURRENT WELDING LITERATURE

was attached. Oxygen pressure on pipe was 50 lbs. per square inch and 75 lbs. on the torch. Cut started with torch and finished with Oxygen jet.—Acetylene Journal, December, 1924.

OXY-ACETYLENE WELDING FOR THE CONTRACTOR—Utilizing the blowpipe in the maintenance and repair of construction equipment. The article describes the use of the oxy-acetylene process in the repair of steam shovel cranes, derricks, gear teeth, and the dismantling and repairing of iron columns, dredge pipes, steel cable, tunnel lining, etc.—Oxy-Acetylene Tips, December, 1924.

COSTLY ALUMINUM CASTING SAVED BY WELDING—Description of welding of cracked aluminum lid of rotary bottling machine in brewery.—Oxy-Acetylene Tips, December.

WHAT OXY-ACETYLENE EQUIPMENT DOES FOR THE SHEET METAL SHOP—Adapting the oxy-acetylene process to the many jobs in the sheet metal shop. Making of perforated cylinders, laboratory stills, workmen's stands and benches, etc. Work on a variety of metals described.—Oxy-Acetylene Tips, December.

METHODS EMPLOYED IN SCRAPPING WARSHIPS, by Commander Henry E. Russell, U. S. N.—Article deals with the advantages of the oxy-acetylene torch in this work, as contrasted with other processes.—Iron Age, December 11, 1924.

TOOL SALVAGE, by L. A. Churgay.—This process not limited to reclaiming of damaged implements, but also includes the reworking of obsolete devices so as to render them adaptable to modern practices. Article shows welding to be an invaluable process in this work.—American Machinist, December 4, 1924.

WELDING TANKS BY OXY-ACETYLENE PROCESS—Continued from October Issue The Welding Journal. Preparation for welding round tanks and jig used. How to reinforce rectangular tanks. Building up tank ends.—The Welding Journal, November, 1924.

BRONZE WELDING OF CAST IRON PIPE, by H. R. Swartley—paper read before the 25th annual convention of the International Acetylene Convention, also printed in the November issue of Oxy-Acetyelen Tips and in the December issue of the Acetylene Journal. Historical aspects of cast iron lines. Various types of joints. Centrifugal cast iron pipe. Development of bronze welding. Ripple weld most suitable. Size of welded bronze collar should be of such dimensions that the joint strength under any combination of stress will be at least as great and preferably greater than the pipe. Bronze welded fittings for pipe work eliminates the stocking of many varieties and sizes. Bronze welding suitable for joining large diameter pipes, large pipes to smaller ones, and many other things helpful in the pipe laying field and the building industry.

OXY-ACETYLENE WELDING OF NON-FERROUS METALS, by Alfred S. Kinsey.—Continuation of article started in the November Acetylene Journal. Takes up the welding of nickel and lead, giving interesting data. Acetylene Journal, December, 1924.

STEEL WIRE, by E. A. Atkins.—Its manufacture, properties and uses for welding and other purposes. Paper read, before the Institution of Welding Engineers, is discussed in detail. Many good ideas brought forth. The Welding Journal, November, 1924.

CUTTING LARGE SALAMANDERS TO MELTING SIZE—Interesting job done with auxiliary oxygen jet. Operators cut 120 tons of this material with jet used in connection with cutting torch. Equipment consisted of 5-cylinder oxygen manifold, regulator, hose, and 16 foot length of ¼-inch gas pipe, to the end of which the hose

WELDING MACHINES:—The specifications of the ten types of Todd twin-pole arc welders are outlined in a folder which is issued by the Todd Oil Burner & Engineering Corporation, 25 Broadway, New York City.

BOILER REPAIRS BY OXY-ACETYLENE AND THE ELECTRIC ARC.—Recommendations of a committee formed from boiler constructors in France. It is pointed out by M. Granjon that these are recommendations and not regulations. Ignorance of many welders on this class of work justifies their severity.—Revue de la Soudure Autogene, October, 1924.

WELDING IN THE ALUMINUM PLANT AND VESSEL INDUSTRY.—Illustrated description of the welding of large vessels. If welding operation and quality of sheets are satisfactory this is easily carried out.—Revue de la Soudure Autogene, October, 1924.

REINFORCEMENT OF WELDS.—Effects of reinforcing welds which applies equally to acetylene and electric welds investigated. With a factor of safety of 4.75 and an efficiency of 70 per cent, for the joint, a plate thickness of ½ inch is required for boiler work when there is no reinforcement. The boiler can be constructed from ⅜ inch plate when there is a reinforcement of 30 per cent of the plate thickness.—Acetylene et Soudure Autogene (Suisse), November, 1924.

A STUDY OF THE OXYGEN-OIL EXPLOSION HAZARD.—Investigation made by Dr. D. Hersey, of the Bureau of Mines. Information given indicates ignition temperature of oxygen-oil mixtures from 120° to 170° Cent. When a few drops of mineral lubricating oil are sufficiently warmed up to explode spontaneously in a bomb of 4 cubic centimetres (0.25 cubic inches) volume, it is stated that an initial charging pressure of 1800 to 2000 lbs. per sq. inch may lead to an explosion pressure of 20,000 lbs. per sq. inch.—Journal of the American Society of Naval Engineers.

OXY-ACETYLENE WELDING SENDS WORLD CRUISERS ON THEIR WAY.—An account of how two of the world fiers' planes were reconditioned for continuation of their flight. In landing in New Orleans, two of the planes broke shock absorbers. Oxy-acetylene process was rushed to the job and repaired the damage.—Oxy-Acetylene Tips, January, 1925.

OXY-ACETYLENE BLOW PIPES FOR WELL DRILLERS.—Description of the use of oxy-actylene cutting in the drilling of wells. An account of the fitting a coupling in a 15" wrought iron casting in the well which was used for municipal water supply—Oxy-Acetylene Tips, January, 1925.

SIMPLIFYING, DESIGNING AND CONSTRUCTION OF INDUSTRIAL BUILDINGS—Article points to the saving of time and expense which may be realized by the proper use of the Oxy-Acetylene process in designing industrial plants. The article lists runways, balconies, stairways, shoots and hoppers, guards and supports as articles which may be easily built by welding.

THE MOVING OF AN OLD VAULT—On the occasion of the Texas bank moving to the new and larger quarters, an old vault had to be removed. A charge of $100.00 per day for each day the vault was allowed to remain in the vacated building faced the owners of the bank. The oxy-acetylene process solved the problem in handling and disposing of the antiquated vault.—Oxy-Acetylene Tips, January, 1925.

RESISTANCE WELDING, by F. E. Saunders.—Contents of a paper read before the Institution of Welding Engineers, London, dealing with the fundamental principals of resistance welding, description of popular machines, and the several applications to which the process may be put.—Welding Journal, London, 1924.

KENT'S MECHANICAL ENGINEERS' HANDBOOK—John Wiley & Son, Inc., 440 Fourth Avenue, New York City, announces that Kent's Mechanical Engineers' Handbook is being published in a two-volume set, listed at $8.00 per set. The "Handbook" is still available as one volume.

WELFEX—The Chemical Treatment Company, 26 Broadway, New York City, has just issued a ten-page booklet describing its iron or steel welding flux, known by the trade name of Welfex. In addition to listing lot prices of the article, the catalogue also gives directions for the proper use of the flux.

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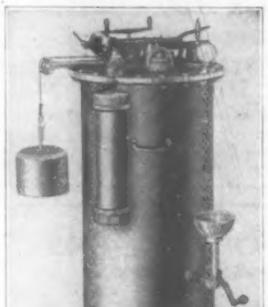

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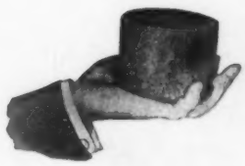

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